FAA
Air Traffic Organization

Air Traffic Organization 2014 Safety Report

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In 2014, Federal Aviation Administration (FAA) Administrator Michael P. Huerta outlined the agency's four major priorities for the next five years: 1) making aviation safer and smarter; 2) delivering benefits through technology and infrastructure; 3) enhancing global leadership; and 4) empowering the FAA's people. These priorities have guided the Air Traffic Organization (ATO) over the course of fiscal year (FY) 2014, a year in which we carried out significant innovations at home, communicated our progress globally, and, at the same time, ensured the continued fulfillment of our core mission: to provide the safest, most efficient airspace system in the world.

Our success is not by chance. It is the result of a careful approach to the planning and execution of that core mission. Everything we do is informed by our Safety Management System (SMS)—an integrated set of principles, procedures, and tools—that begins with our employees, is supported by a positive safety culture, and helps focus our resources on the most pressing issues in the National Airspace System (NAS). Thanks to our SMS, we are collecting more and better safety data than at any time in the past, allowing us to base our decisions at all levels of the organization on a more complete picture of the safety—and risk—of the NAS.

To make the most of our SMS, we formulate a series of high-level but concrete goals each year intended to improve our safety management capabilities and, thereby, our overall safety performance. In FY 2014, those goals included:

- Measuring more accurately the effectiveness of our hazard mitigation strategies

- Developing a more dynamic, data-driven training curriculum

- Developing tools to improve our ability to analyze safety risks

- Advancing Next Generation Air Transportation System safety initiatives

- Aligning the assumptions built into our safety simulation models

- Addressing safety issues affecting the organization as a whole

We met all of these goals, accomplishing a total of 20 broad-sweeping initiatives by the end of the year. As a result of these and other ongoing safety activities, the services we provide have improved measurably. Responsible for more than 25 million flights in FY 2014, the ATO conducted 99.994 percent of all air traffic operations in full compliance with FAA safety standards. Not only that, but we limited serious runway incursions to a rate of 0.282 per million operations (exceeding our target of 0.395 per million), fully implemented 16 of our 17 annual top-priority risk mitigation strategies (again beating a self-imposed target of 80 percent), and addressed more than 100 safety concerns brought to light by our frontline personnel.

Drawing on information gathered from the ATO's numerous metrics and safety programs, this report demonstrates our deep commitment to Administrator Huerta's priorities. When it comes to safety, there will always be areas to improve, but in FY 2014 we are proud to have made such significant progress in honoring our promise to the American public: that all air travelers will arrive safely at their destinations.

Teri L. Bristol

Chief Operating Officer
Air Traffic Organization, Federal Aviation Administration

Summary

The first priority of the Air Traffic Organization (ATO) is safety. Thanks in large part to our commitment to this priority, the U.S. National Airspace System (NAS) is the safest in the world, while also being the most efficient, diverse, and complex. We consistently meet, and often exceed, our own increasingly demanding safety performance targets.

Our success in fiscal year (FY) 2014 was driven by an approach to safety management that we call "Collect, Find, Fix" (Figure 1). This approach seeks to maximize the available pool of actionable data, use those data to identify areas of potential risk, and by analyzing and quantifying that risk, prioritize the safety initiatives we execute. Adhering to this structure, we can identify emerging issues and mitigate their effects before any serious incident can occur.

Figure 1: Collect, Find, Fix
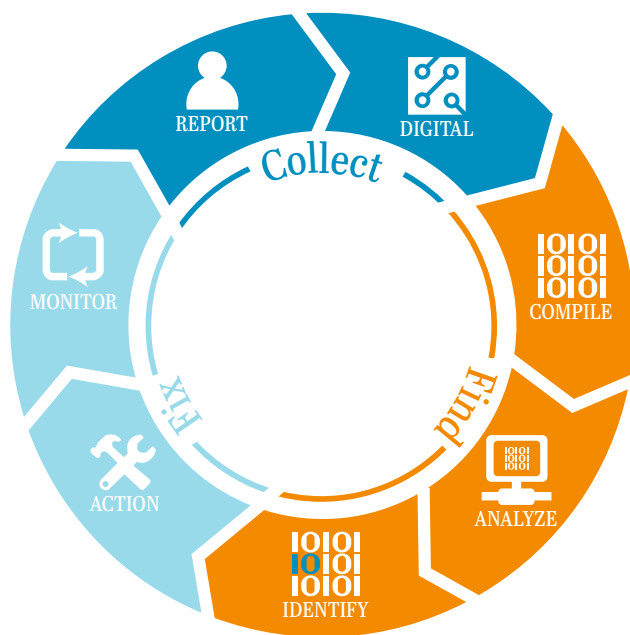
The ATO's data collection, safety assessment, and risk mitigation efforts—all essential to risk-based decision-making—are made possible by the policies, procedures, and tools that compose our Safety Management System (SMS). In FY 2014, we successfully deployed and trained the latest version of the SMS, ensuring that the foundational elements of our approach to safety, elements that guide our work every day, are abreast of the most recent advances in safety research and technology.

Also in FY 2014, we took a comprehensive look at the maturity of our SMS for the first time since its full implementation in 2010. Relying on SMS maturity-level guidance developed by the Civil Air Navigation Services Organisation (CANSO), a global consortium of air navigation service providers, the ATO gathered evidence from every corner of the organization and, after intensive analysis, determined that the vast majority of our SMS has attained the highest maturity level possible in CANSO's model, that of Continuous Improvement (Figure 2). In only three of the 17 SMS assessment areas is the ATO still working toward Continuous Improvement.
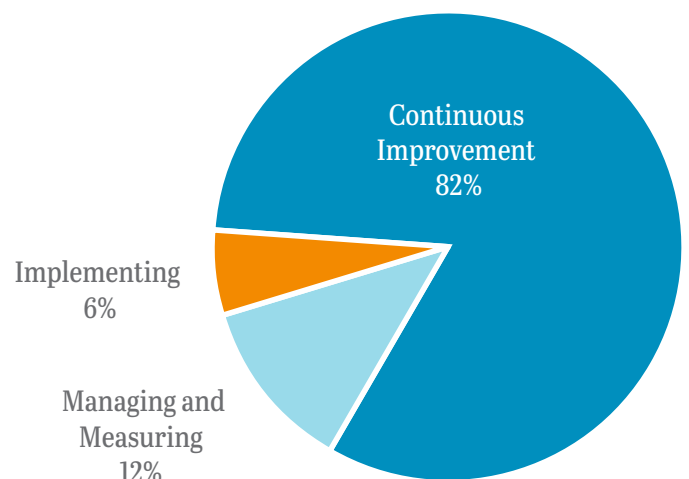

Figure 2: SMS Maturity Level

To improve the quantity and quality of our data, we enhanced our Risk Analysis Process (RAP)—first, by increasing the objectivity of our Airborne RAP and, second, by developing two new iterations of the process: Surface RAP for incidents that occur on airport movement areas and Service Integrity RAP for maintenance- and infrastructure-related incidents. Data generated by the Airborne RAP inform the Top 5 safety hazards—a tangible example of risk-based decision-making at work—and feed some of our most important performance metrics, such as the System Risk Event Rate (SRER), a 12-month rolling rate that compares the total number of airborne losses of required separation with those that meet the criteria for high-risk losses (Figure 3). The rate depicts the number of high-risk Risk Analysis Events (RAE) per 1,000 total airborne losses of separation. As the data collected in FY 2014 show, the SRER declined steadily over the second half of the year.

Our safety reporting programs—voluntary, mandatory, and automated—provide most of the data we use to measure our performance. In FY 2014, our Air Traffic Safety Action Program (ATSAP) remained the world's largest Voluntary Safety Reporting Program (VSRP), measured by volume of reports (Figure 4). We also improved the ATSAP website for use with mobile devices, allowing frontline personnel to file reports more conveniently, and began disseminating ATSAP data and trends to Local Safety Councils in each of our facilities, giving more data to those best positioned to address issues at the local level.
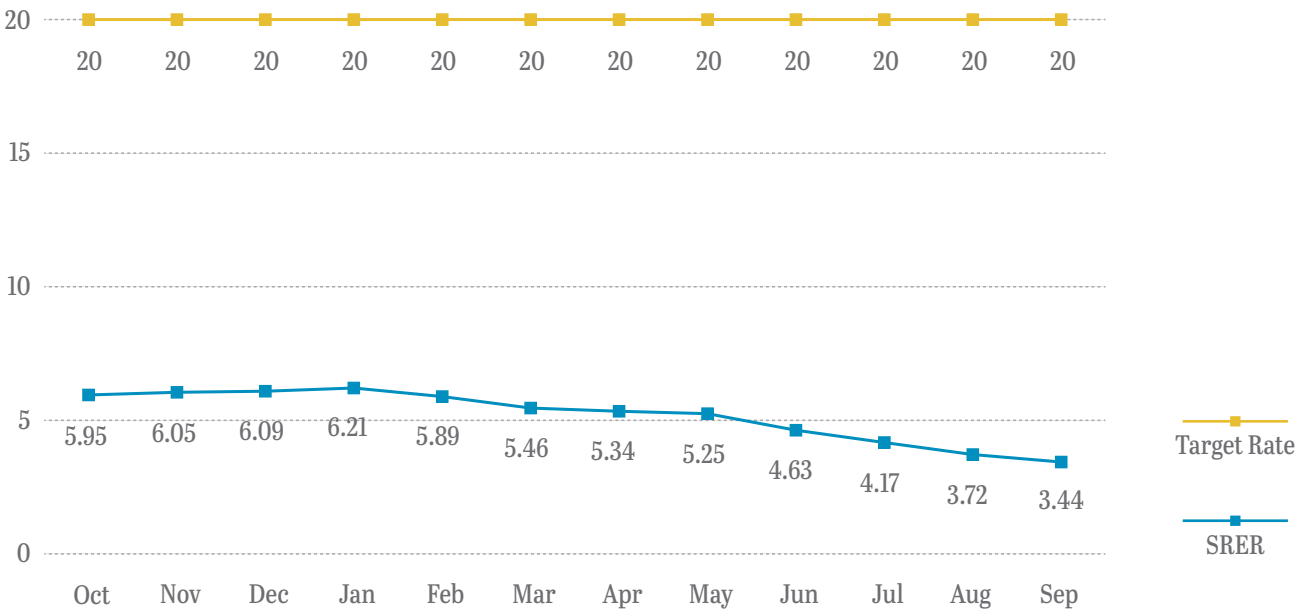

Figure 3: ATO System Risk Event Rate (SRER), FY 2014

FY 2014 also saw the nationwide rollout of our Technical Operations Safety Action Program (T-SAP), which is now collecting important data from all three of our Service Areas (Eastern, Central, and Western), and the continued growth of the Confidential Information Share Program (CISP), which facilitates the exchange of safety data between ATSAP and our airline partners' Aviation Safety Action Programs (ASAP) (Figure 4).

Figure 4: VSRPs by the Numbers, FY 2014	
ATSAP Reports Filed	17,312
ATSAP Positives	76
T-SAP Reports Filed	120
T-SAP Positives	4
CISP Reports Exchanged	13,377
CISP Positives	21

In FY 2014, our emphasis on reducing the risk posed by serious runway incursions (defined as category A and B incursions)—another important safety performance indicator—focused on better reporting and analysis methods. Data gathered in FY 2014 indicate that 14 serious runway incursions occurred; the vast majority of incursions (categories C and D) pose no risk of collision (Figure 5). We also introduced new technologies, such as the Closed Runway Operation Prevention Device (CROPD), designed to help controllers prevent incursions before they happen.

The aviation industry generally measures safety performance in terms of accidents. To be consistent with the industry, the Federal Aviation Administration (FAA) has for many years measured aviation safety in terms of fatal accident rates, focusing on two primary metrics: 1) the rate of fatalities on board commercial air carrier flights[1] per 100 million persons on board, and 2) the rate of fatal general aviation (GA)[2] accidents per 100,000 flight hours. In FY 2014, the ATO began to track our own contribution to aviation accidents by identifying and analyzing fatal accidents for which the National Transportation Safety Board (NTSB)[3] determined that a deficiency in air traffic services was causal or contributory. The ATO examines the NTSB reports on these accidents, along with data from our own investigations and other sources, to understand the hazards that lead to accidents and prevent those hazards from recurring.

Air traffic management (ATM)–related fatal accidents account for less than 2 percent of all fatal accidents in the NAS (Figure 6). Since 2002, there has been one fatal air carrier accident in which an air traffic service deficiency was identified as a contributing factor. With over 700 million passengers each year, the 10-year ATM-related commercial air carrier fatality rate is 0.65 fatalities per 100 million persons on board.[4] Over five billion passengers have flown on commercial flights receiving ATO services since the last ATM-related air carrier fatality in 2006.

Category A 0.40%
Category B 0.71%
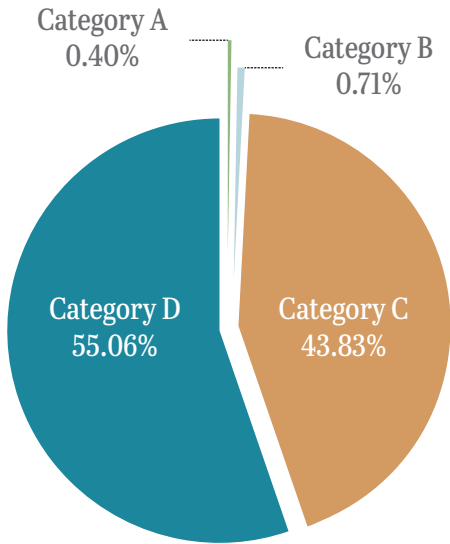Category D 55.06%
Category C 43.83%

Figure 5: Runway Incursions by Category, FY 2014

[1]For the purposes of the ATO's fatality metrics, the category of commercial air carriers includes scheduled and non-scheduled passenger flights, as well as cargo flights. It excludes on-demand service and general aviation.

[2]The category of GA includes on-demand and GA flights.

[3]The NTSB is an independent federal agency charged by Congress with investigating every civil aviation accident the United States. The NTSB determines the probable cause of the accidents (it is the only federal agency with the authority to do so) and issues safety recommendations aimed at preventing future accidents.

[4]Due to the number of NTSB Final Accident Reports pending for calendar year (CY) 2012–14, those data have been excluded from the ATO's current 10-year rate calculations.
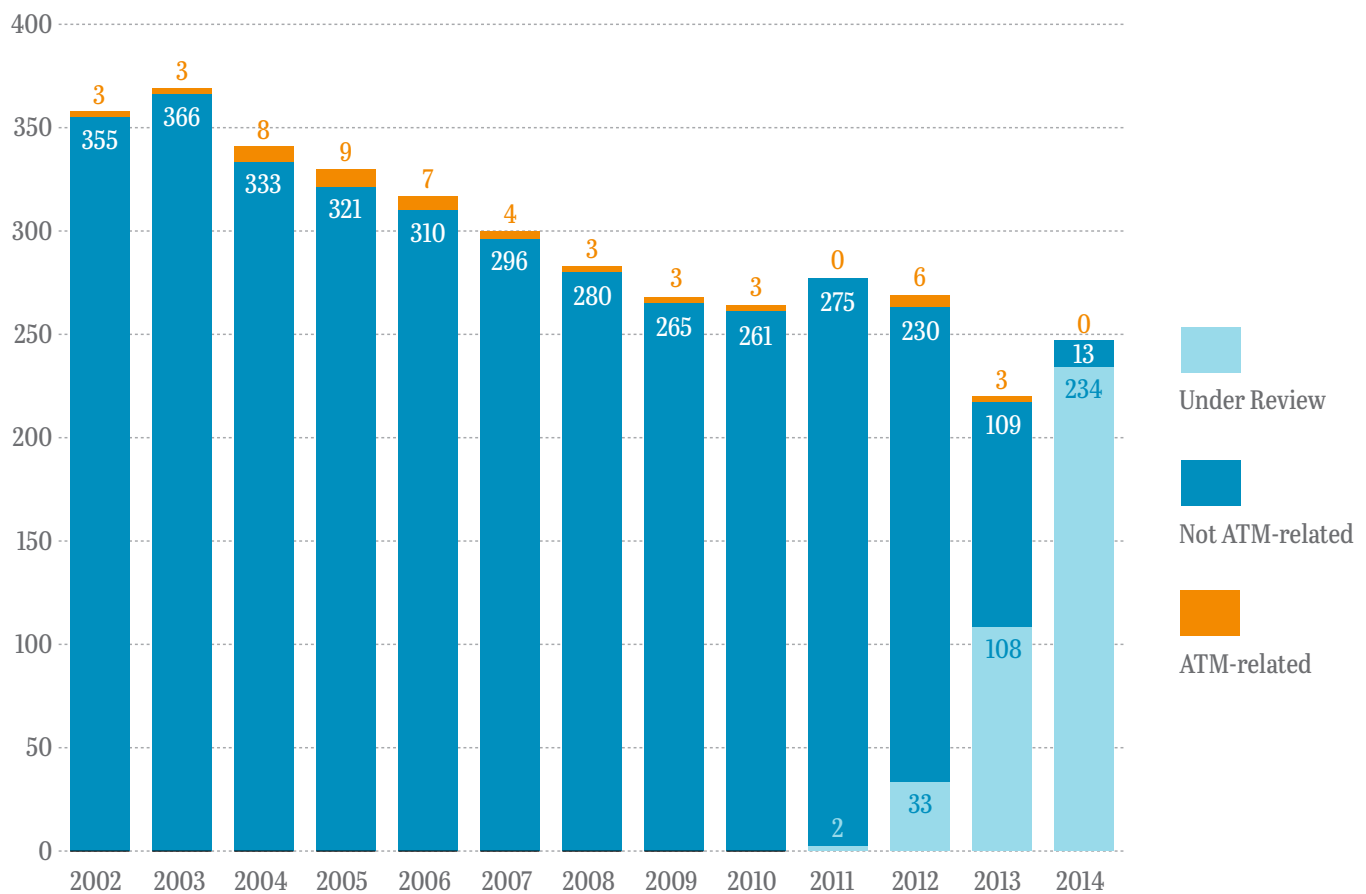
Since 2002, deficiencies in air traffic services have contributed to 51 fatal GA accidents. The 10-year rate of ATM-related GA fatal accidents per 100,000 flight hours is 0.016.[5]

Finally, the ATO has a robust Key Performance Indicator (KPI) program that, by leveraging big data, provides us with ways of monitoring operational performance parameters in real time, which, in turn, allows us to detect emerging issues and address those issues before they become hazards. One of the highlights of this program in FY 2014 is the Converging Runway Operations (CRO) KPI.

The CRO KPI was developed to help the ATO examine the potential risk of situations where the flight path of an arrival aircraft executing a missed approach and that of a departing aircraft could result in a loss of required separation minima. Acting to mitigate this risk, the ATO published new policy and procedures governing CRO and released a decision support tool for air traffic controllers.

By focusing on Collect, Find, Fix, we have made, and will continue to make, the best possible use of the data and resources available to us, gradually transforming the way we ensure the safety of our services. Undoubtedly, there will be many challenges along the way. But as the metrics, safety programs, and processes highlighted in this report show, the ATO has the dedication and leadership needed to overcome those challenges and continue to meet our safety goals.

[5]Due to the number of NTSB Final Accident Reports pending for CY12–14, those data have been excluded from the ATO's current 10-year rate calculations.

Safety Performance Indicators

Every incident in the NAS—from front-page violations of required separation minima to the most seemingly minor glitches reported by our controllers—represents an opportunity for the ATO to collect valuable safety data and correct problems. Throughout FY 2014, we continued to refine our safety management mechanisms, ensuring the rigor of our methods and the objectivity of their outcomes.

Risk Analysis Process

The ATO categorizes certain safety incidents—those that violate predefined safety parameters—as Risk Analysis Events (RAE) and subjects them to a rigorous Risk Analysis Process. RAP—an approach to safety assessment designed to be consistent, objective, and comprehensive—is conducted by a panel of experts that, depending on the nature of the incident, may include pilots, controllers, technicians, and safety specialists. These panels examine each incident against a set of criteria, then, using a software tool, assess and quantify its level of risk. Expressed as low, medium, or high, the risk level of any given RAE is determined by establishing the incident's severity and likelihood of recurrence.
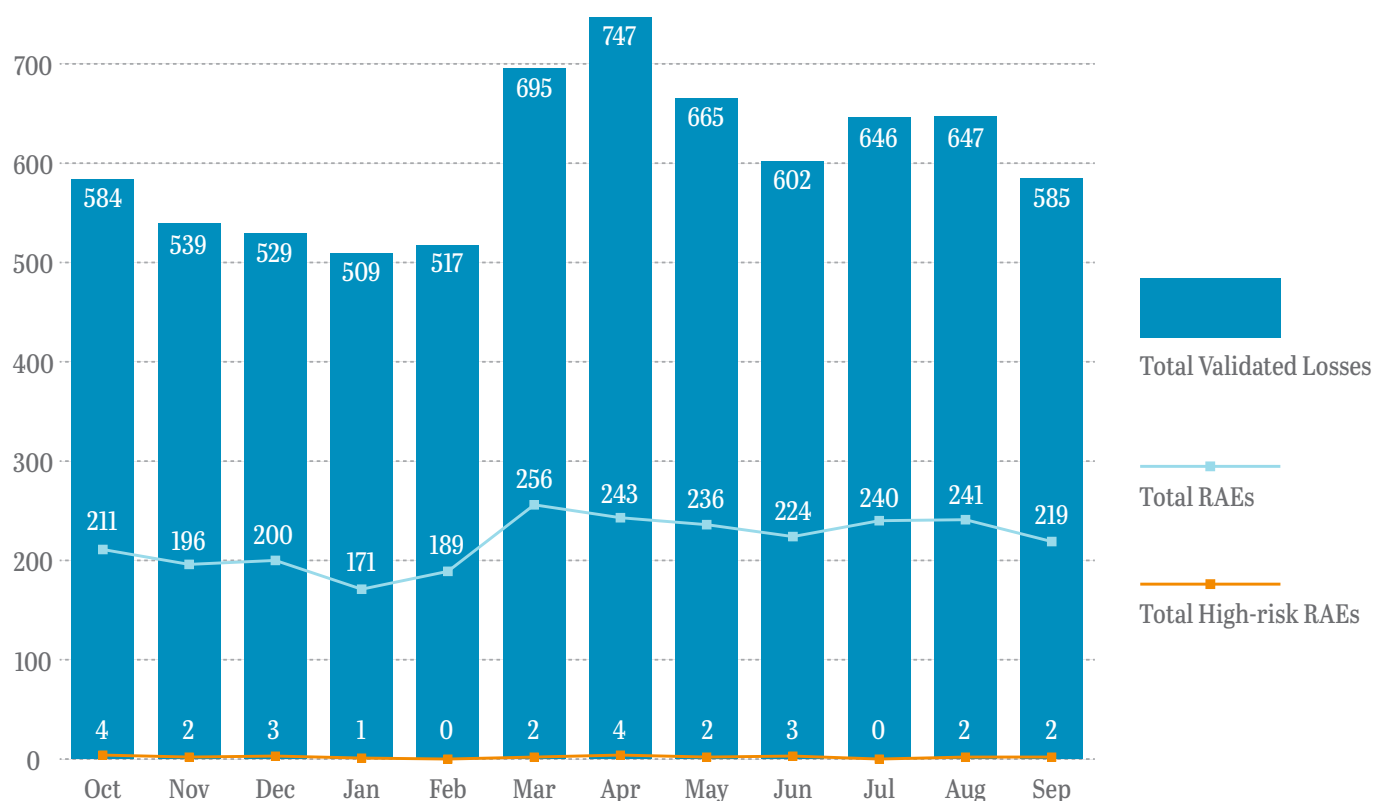
Among other benefits, RAP has allowed us to:

- Increase the amount of safety data that we analyze
- Align our risk analysis approach to those of our international partners
- Integrate a variety of personnel and system performance information
- Identify more effectively issues that contribute to NAS-wide risk
- Avoid underreporting and misclassification of incidents

In FY 2014, the ATO improved and expanded RAP. First, we redesigned the Airborne RAP tool to make its results better reflect each incident's actual risk. Second, we extended the benefits of the Airborne RAP to other, equally important areas of the NAS by developing two additional varieties of RAP: one devoted to incidents that occur on airport movement areas, called the Surface RAP, and one devoted to events that compromise the integrity of our infrastructure, known as the Service Integrity RAP.

Airborne RAP

Each year, Airborne RAP panelists evaluate thousands of events in which required separation was lost; their purpose is to determine the risk that, individually, those events pose to our airspace and whether, grouped, they indicate any systemic trends (Figure 8). The ATO uses those same data to calculate the SRER, which gives us a picture of the safety performance of the entire system (see Figure 3). Thanks to advances in our data collection methods, the granularity of the data that we work with and the precision of our assessments have improved steadily since 2011, when the process was first implemented.

Figure 8: Airborne RAP by the Numbers, FY 2014	
Total Air Traffic Operations	130,992,458
Processed Loss Reports	298,203
Validated Losses of Separation*	7,265
Non–RAEs	4,639
RAEs	2,626
High-risk RAEs	25
Medium-risk RAEs	854
Low-risk RAEs	1,747
Percentage of Air Traffic Operations with No Loss of Separation	99.99445

* The remainder of the processed loss reports documented losses that did not meet the minimum criteria for an RAE.

In FY 2014, we incorporated historical NAS data into the Airborne RAP tool and expanded its list of causal factors to more than 500, making the tool more precise and objective. We also redesigned the tool to include what is known as a barrier model. This barrier model represents the NAS's layers of defense (air traffic control actions, pilot actions, and the NAS technological infrastructure), each of which is composed of many elements designed to prevent a loss of required separation from occurring or prevent a loss from becoming a collision (Figure 9). In addition to calculating an aggregate risk score, the Airborne RAP tool now provides specific scores for each barrier category, allowing safety analysts to inspect more closely the effectiveness of individual barriers and the factors that influence their performance.

This enhanced version of the Airborne RAP tool is currently in the final stages of testing; deployment is expected in FY 2015.
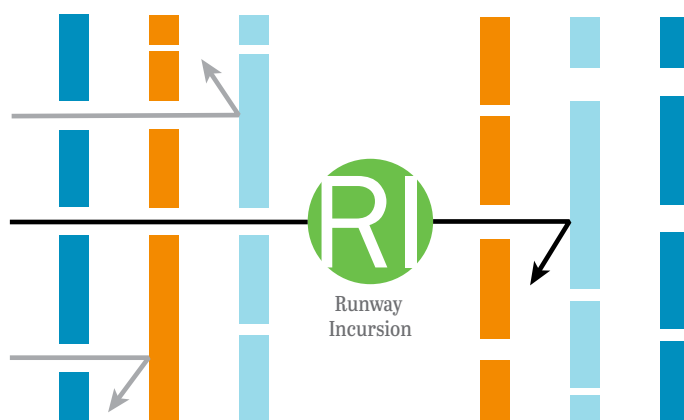

Figure 9: Barrier Model Concept

Surface RAP

In FY 2014, the ATO deployed the Surface RAP, which is designed to analyze surface incidents (specifically, runway incursions). Like the Airborne RAP, the Surface RAP uses a combination of severity and repeatability to arrive at a quantified measure of risk. However, unlike the airborne environment, which includes only fixed barriers (pilot communication, controller decisions, and other factors that are considered to be a part of the NAS no matter where the incident occurs), the surface environment also includes flexible barriers that may or may not be present at a given airport (for example, a specific runway lighting system). The Surface RAP also accounts for temporary surface conditions, such as runway closures and construction activities.

Service Integrity RAP

Also in FY 2014, the ATO rolled out the Service Integrity RAP to assess the risk associated with any unexpected failure, interruption, or degradation of NAS equipment or services that could affect the ATO's ability to provide safe air traffic control or flight information services. To qualify as a Service Integrity Event, an incident must adversely affect communication, navigation, surveillance, automation, and/or information services. This new process promises to systematize the way we identify technical issues that impact operations, allow us to better understand those issues, and guide our resources toward the issues that pose the most risk.

Voluntary Safety Reporting Programs

The ATO's frontline personnel are one of our best sources of safety information. Through our Voluntary Safety Reporting Programs (VSRP)—which are confidential and non-punitive—those directly involved in air traffic control, system service, and airline operations have brought to light vital safety concerns, allowing us to address the causal and contributing factors of emerging issues before an incident occurs.

These VSRPs are also contributing to an appreciable change in the ATO's safety culture. By encouraging employee participation in the safety decision–making process and by removing the fear of reprisal, they have helped to change employee attitudes about sharing incidents and issues, increased accountability at the individual level, and, importantly, promoted a proactive approach to safety.

We continued to refine our VSRPs throughout FY 2014, improving the quantity and quality of safety data collected and analyzed; these data are used extensively by our RAP panels, and ultimately help inform risk-based decision-making, both of which allow us to develop more targeted and effective risk mitigation strategies.

Corrective Actions

To ensure that our approach to safety issues is systematic, the ATO relies on a corrective action process that involves Corrective Action Requests (CAR) and Corrective Action Plans (CAP). CARs describe an issue to be addressed and constitute a formal request that those responsible mitigate its risk; CAPs are developed in response to CARs and detail the course of action that the responsible parties will take to correct or control the issue. To ensure that our mitigations are effective, all CAPs must include a monitoring plan with specific data sources and safety targets.

Air Traffic Safety Action Program

The ATO's Air Traffic Safety Action Program (ATSAP), the largest aviation VSRP in the world, allows air traffic controllers and their managers to confidentially report safety issues and suggest solutions to those issues (Figure 10). Since its inception in FY 2008 through the end of FY 2014, a total of 90,297 ATSAP reports have been filed. In FY 2014, 78 percent of the submitted ATSAP reports described specific events, while the remaining 22 percent provided insights into policy, procedure, or equipment issues.

Figure 10: ATSAP by the Numbers, FY 2014	
ATSAP Reports Filed	17,312
ATSAP Information Requests Issued	10
CARs Issued	7
CARs Closed	6
ATSAP Positives	76
Eligible Employees Who Filed at least One ATSAP Report	7,660
Percentage of Eligible Submitters Registered for ATSAP	91

Several key improvements were made to ATSAP in FY 2014:

- Frontline personnel can now file reports using their mobile devices, allowing them to conveniently capture issues while fresh in their minds or in the absence of a computer.

- ATSAP data and trends are now disseminated to Local Safety Councils, providing relevant, timely information to those best positioned to address risks at the local level.

- Sensitive ATSAP information and the personnel responsible for filing such information are now protected by federal regulations, further encouraging employee participation in the program.

ATSAP data have proved extremely valuable to the successful execution of the ATO's safety mission. In FY 2014, the three ATSAP Event Review Committees (which represent each of the ATO's three Service Areas) issued seven CARs addressing safety issues identified via ATSAP; there are currently more than 50 ATSAP-related CAPs, which document the mitigation strategies prescribed in response to the CARs, at various stages of implementation. Second, the ATSAP Team provided 99 formal ATSAP data analysis reports to offices and workgroups carrying out ongoing mitigation strategies. Finally, by integrating ATSAP data with other available operational data, safety analysts have at their disposal a great deal of the information necessary to develop effective hazard mitigation strategies.

ATSAP reports can be parsed in any number of ways. As mentioned above, FY 2014 problem reports comprised approximately 22 percent of total FY 2014 ATSAP reports. Figure 11 depicts the subjects most cited in these reports. This is an important area of emerging analysis, as the identification of systemic risk offers the best opportunity to target issues that have roots in the same organizational gaps. It should be noted that a single problem report may indicate problems in several categories.
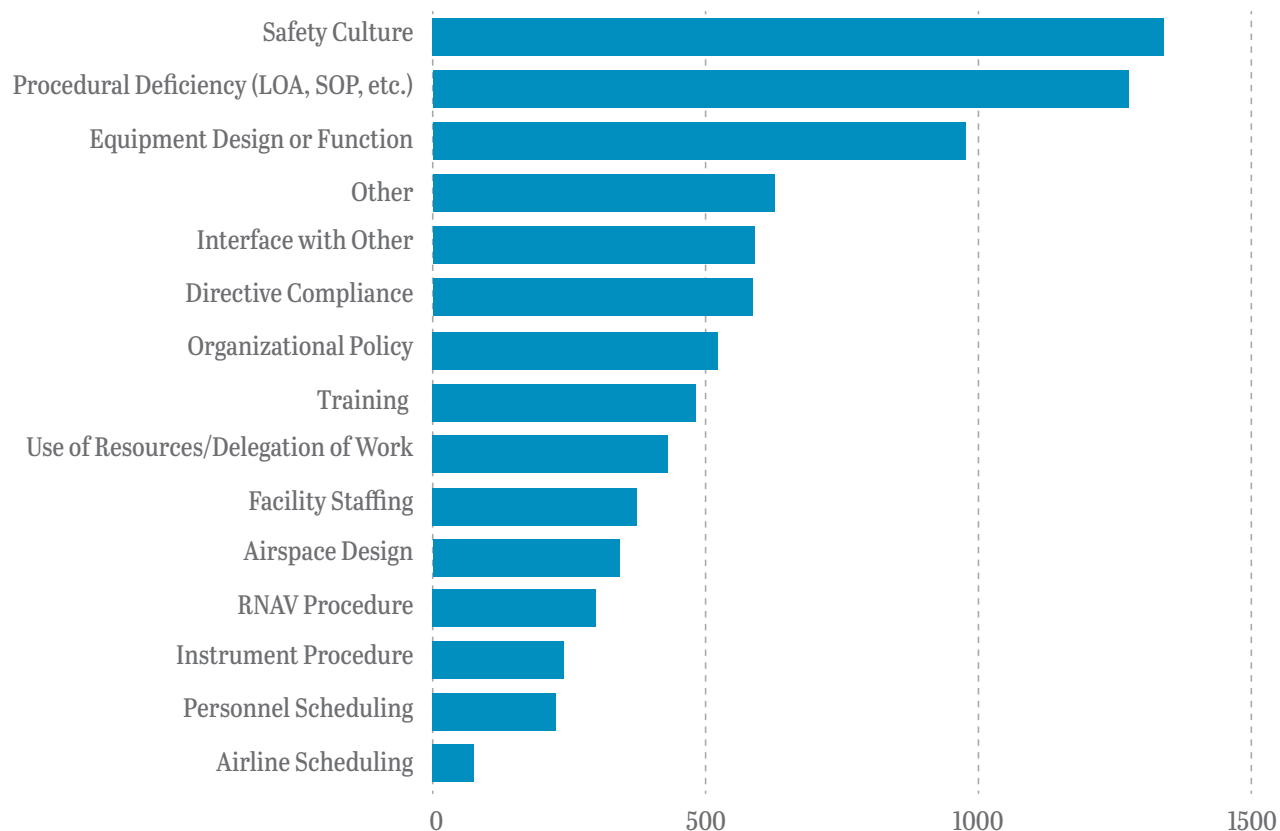
The ATO's VSRPs document successes through Positives; each Positive is a successful resolution to a safety issue reported by personnel. In FY 2014, there were a total of 76 ATSAP Positives, including the following:

- Conflicting departure procedures for Daytona Beach International Airport, which had been in conflict since 2010, were amended, reducing the likelihood of unexpected pilot actions.

- The Letter of Agreement between Columbus Air Force Base (CBM), Naval Air Station Meridian, and the U.S. Air Force was revised to require pilots exiting a Visual Flight Rules (VFR) military training route to contact CBM directly for Instrument Flight Rules (IFR) clearance, resulting in more efficient handling of IFR pickups.

- As a result of multiple minimum altitude violations reported near Seattle Air Route Traffic Control Center, the Allied Pilots Association published a safety bulletin clarifying a particular arrival route into Portland International Airport.

Technical Operations Safety Action Program

In FY 2014, the Technical Operations Safety Action Program (T-SAP), which provides the ATO's technicians with an avenue to report infrastructural safety issues, was implemented in the Eastern and Western Service Areas, completing the program's nationwide deployment (T-SAP was deployed in the Central Service Area in FY 2013) (Figure 12). The effort included a training program completed in just eight weeks that targeted 16 districts and helped to bring the total number of personnel eligible to submit T-SAP reports to approximately 7,800.

Figure 12: T-SAP by the Numbers, FY 2014	
T-SAP Reports Filed	120
T-SAP Information Requests Issued	63
CARs Issued	37
CARs Closed	18
T-SAP Positives	4

T-SAP Positives for FY 2014 included the following:

- An improperly installed high-voltage transformer feeding an FAA facility was replaced with an enclosed transformer, eliminating a serious hazard with the potential to cause personnel injury and disrupt air traffic control services.

- A fall hazard at glideslope stations was mitigated by issuing an advisory that alerted field personnel to a Standard Operating Procedure used successfully in the Western Service Area.

- A report on the inspection and tightening of latches on Terminal Controller Workstation assemblies was issued, preventing potential service disruptions and personnel injuries.

Confidential Information Share Program

By providing a conduit for ATSAP and our industry partners' ASAPs to exchange safety information, the Confidential Information Share Program (CISP) helps foster mutual understanding of aviation safety issues from both the air traffic and flight crew perspectives (Figure 13). In FY 2014, participation in CISP expanded from 13 to 19 airlines, with Delta Air Lines and Silver Airways among the newest members. In the past year, a total of 13,377 reports were exchanged through CISP.

Figure 13: CISP by the Numbers, FY 2014	
ASAP Reports Submitted to ATO	8,752
Redacted ATSAP Reports Submitted to Airlines	4,625
Total Reports Exchanged	13,377
CISP Positives	21

There were 21 CISP Positives in FY 2014, including the following:

- Routes around restricted airspace in Washington, D.C., were clarified.

- Runway-crossing phraseology used at Seattle-Tacoma International Airport was refined to better conform to FAA policy and alleviate pilot concerns during takeoff.

- Similarly named departure routes, which were causing confusion at Chicago Air Route Traffic Control Center, were resolved.
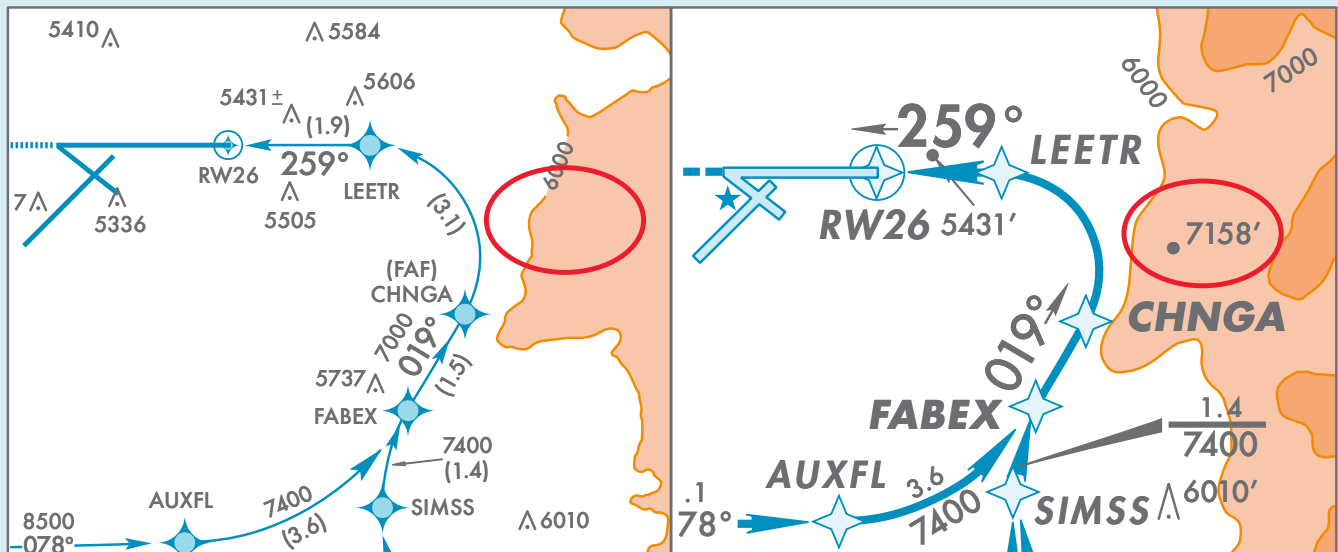
Uncharted Peaks

In FY 2014, CISP member Republic Airways shared information pertaining to previously uncharted 1,000-plus-foot mountain peaks to the east of Albuquerque International Airport. The peaks did not appear on Jeppesen or FAA charts and were missing from the airport's own charting survey, possibly because of their location on the formerly classified Manzano Air Force Base. Jeppesen has now updated its aviation charts (Figure 14), and ATO personnel are working to add the peaks to FAA charts and the FAA obstruction database. After further analysis, some of our industry partners have amended their local pilots' publications and changed their arrival routes into Albuquerque. The ATO is also working with the Air Force Office of Safety to install terrain obstruction lights.

Top 5 Safety Hazards

Each year, the ATO prioritizes the most serious safety hazards in the NAS to establish the Top 5, one of the most visible outcomes of our commitment to risk-based decision-making. Previously, we relied exclusively on RAP and ATSAP data to determine which hazards belonged in the Top 5; today, we have enhanced our knowledge by including data from all of the following sources:

- Airborne RAP
- Surface RAP
- ATSAP
- T-SAP
- ATM-related Fatal Accidents
- Runway Safety Reports
- Operational Safety Assessments
- System Service Reviews
- NTSB

For each Top 5 hazard, an ATO workgroup is tasked with developing plans to assess and, where necessary, improve the policy, procedures, systems, or training associated with occurrences of that hazard. Resources are then dedicated to implementing the necessary mitigation strategies and monitoring their effectiveness for at least two years.

The Top 5 program is a stellar example of Collect, Find, Fix at work: the ATO's SMS prescribes the collection of data and guides concrete changes to improve safety in the NAS; the RAPs facilitate the identification of the causes and risks of the hazards from gathered data; and the Top 5 helps focus resources on fixing safety issues. Each step in the process feeds the next, ensuring that the available resources are deployed when and where they will most improve the safety of the NAS.

In FY 2014, the ATO fully implemented 16 of the 17 approved Top 5 mitigation strategies, or 94 percent, exceeding our 80 percent target (Figure 15).

TOP 5
Hazards by Fiscal Year

FY 2014

Distractions – Job Related

Combining/De-combining Sectors

Aircraft Identity Not Maintained

Position Relief Briefing

On the Job Training

FY 2013

Recovery

Traffic Advisories

Monitor Initial Departure Headings

Similar Sounding Call signs

Conflicting Procedures
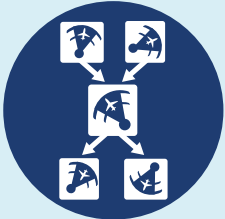
FY 2012

Clearance Compliance Altitude

Go-Arounds

Coordination

Arrival Sequence—Same Alternate Parallel Runway

Arrival Sequence—Speed and Angle

Figure 15: ATO Top 5 Hazards, FY 2014

Hazard	Description	Completed Mitigation Examples
Distraction; Job-related	Activities in the work area and/or other job-related functions affected focus on priority tasks.	• Identify administrative tasks not acceptable to be performed in the operational environment; update facility Standard Operating Procedures accordingly. • Deploy a recurrent training workshop to address causal factors of the hazard.
Combining/De-combining Positions/Sectors	Heavy workload was not mitigated by timely de-combining of positions/sectors.	• Develop and provide a briefing package on the risks associated with combining/de-combining positions/sectors to facility managers to deliver to the Operations Supervisor-in-Charge/Controller-in-Charge. • Issue a change to FAA Order JO 7210.3, Facility Operation and Administration, requiring that "staffing" be included in the determination of airport arrival rates, sector maps, and other system capacity metrics.
Aircraft Identity Not Maintained	Aircraft identification was not effectively transferred and/or maintained.	• Deploy a recurrent training workshop on scanning to address the causal factors of this hazard. • Resolve discrepancies in FAA Order JO 7110.65, Air Traffic Control, related to controller handoff procedures.
Position Relief Briefing	Position relief briefings were not performed well or pertinent elements were omitted.	• Develop a briefing package to raise awareness of the importance of position relief briefings. • Issue a change to FAA Order JO 7210.634, Air Traffic Organization (ATO) Quality Control, requiring that the Internal Compliance Verification tool include the position relief briefing checklist.
On-the-Job Instructor	On-the-Job Training Instructors (OJTI) did not provide timely and effective direction.	• Revise the OJTI supplemental workshop to include OJTI job requirements. • Include the OJTI supplemental workshop in Individual Performance Management training. • Provide a recurrent training course on Introduction to Human Factors in Air Traffic Control.

Runway Safety

The airfield environment is one of the most complex components of the NAS. The dynamic mix of aircraft, surface vehicles, and pedestrians that, moving at different speeds, must share the available taxiways and runways presents a variety of unique safety challenges to ATO personnel and other stakeholders.

Responding to these challenges, we endeavor at all levels of the organization to bring together technical and operational personnel from the FAA and the industry with the common goal of making our airport movement areas as safe as possible.

Thanks to the efforts of the Partnership for Safety (PFS), we now have Local Safety Councils at all FAA-staffed air traffic facilities in the NAS; these councils are given data to help them assess and improve their runway safety performance and tools that allow them to share their best practices with others. In addition to the councils, these facilities also convene a Runway Safety Action Team of key stakeholders at least once a year. The purpose of both the councils and teams is to facilitate collaboration among all stakeholders and improve runway safety performance at their facilities.

Augmenting these and other local efforts, the Surface Safety Initiatives Team works to refine the FAA's surface safety improvement process by selecting, prioritizing, and coordinating across operational stakeholders improvement activities in the surface environment. Its work is supported by Comprehensive Review and Assessment Teams, which conduct assessments at specific airports to identify, validate, and prioritize operational issues that contribute to runway safety shortfalls.

At the national level, an FAA-industry Runway Safety Council (RSC) is responsible for devising systematic approaches to reducing the risks posed by incursions and other surface safety issues. The council's work relies largely on that of a Root Cause Analysis Team (RCAT), which investigates the root causes of specific runway incursions (airport geometry, training, phraseology, and weather, for example). The RSC's strategies, informed by RCAT recommendations and articulated in the ATO's National Runway Safety Plan, offer invaluable guidance to those responsible for regional and local runway safety programs at home and internationally.

National and regional governance councils, comprising executive and regional leadership, meet regularly to ensure that every unit within the FAA with runway safety responsibilities has effective runway safety programs, review regional and national trends and metrics, and promote understanding of an integrated safety picture across the FAA.

Runway Incursions

The ATO measures runway safety by counting the number of runway incursions reported each year by controllers (who are required to report any incident that occurs on a runway) and, in various ways, classifying those incidents. Runway incursions are defined as the incorrect presence of an aircraft, vehicle, or person on a runway and fall into one of four categories (from most to least severe: A, B, C, and D).

On average, there are between three and four runway incursions per day in the NAS; the vast majority of these are minor (categories C and D) and pose no risk of collision. In FY 2014, there were 14 category A and B incursions reported (see Figures 5 and 16); by definition, these were incidents in which a collision was narrowly avoided or which presented significant potential for collision.
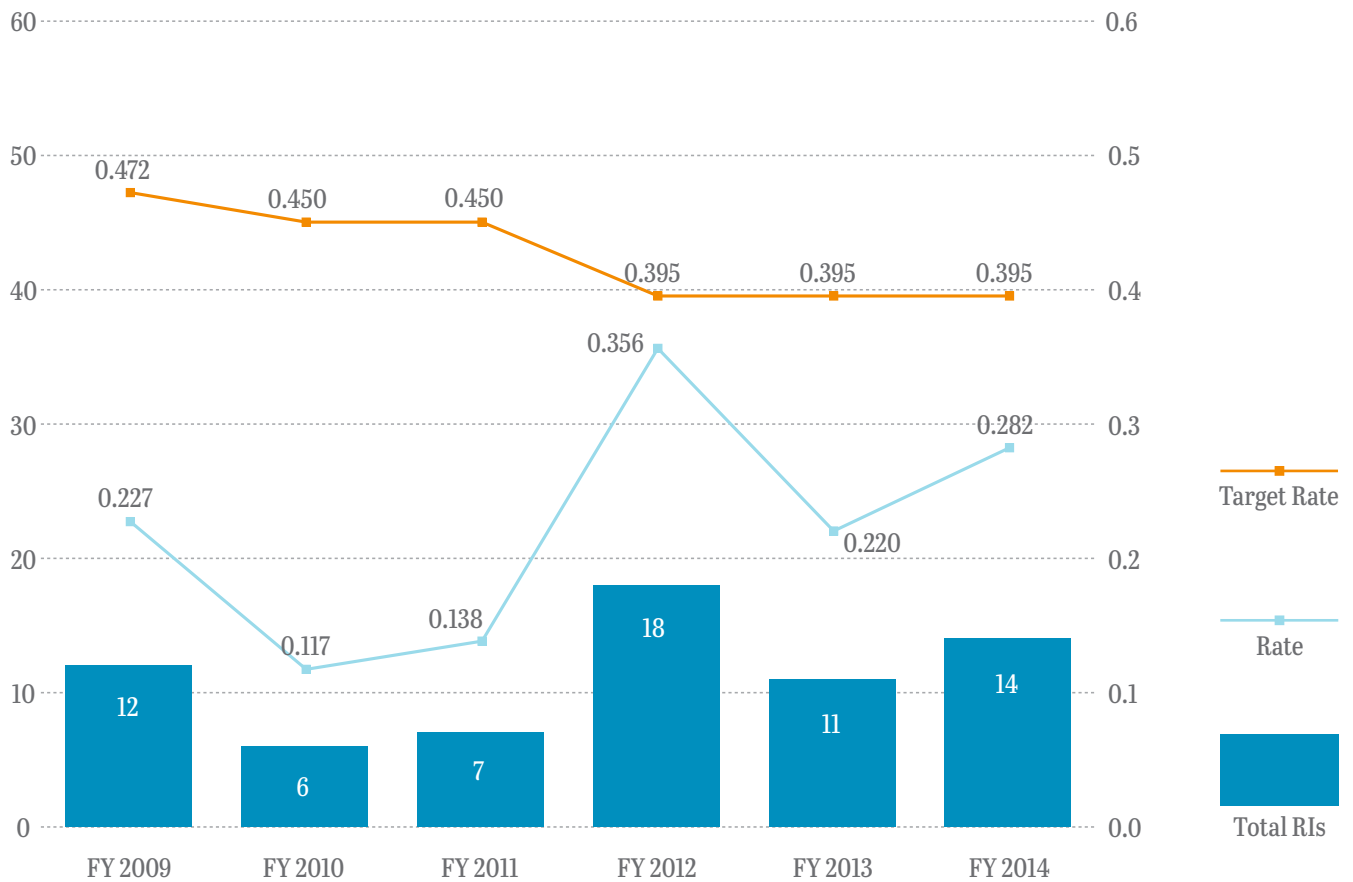
Figure 16: Total Number and Rate of Category A and B Runway Incursions, FY 2009–2014

Over 60 percent of FY 2014 runway incursions involved pilot error and were therefore classified as Pilot Deviations. Vehicle and Pedestrian Deviations composed about 19 percent of all runway incursions. Operational Incidents—which involve an air traffic controller's action or inaction—accounted for the remaining 20 percent, a 6 percent increase from FY 2013 (Figure 17). While other factors likely played minor roles in the upward trend in Operational Incidents, it is primarily due to the increased reporting associated with the success of our VSRPs.

Figure 17: Runway Incursions by Type, FY 2014

In FY 2014, the FAA placed renewed emphasis on runway incursions. We approached the issue with the objective of identifying, analyzing, and mitigating the various risks that exist among pilots, controllers, and drivers.

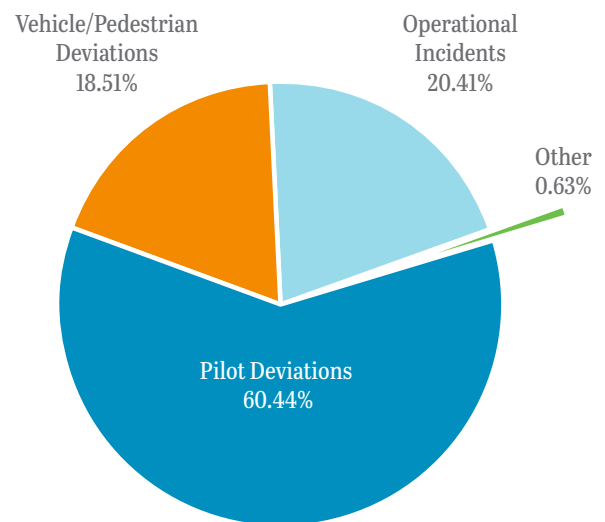By focusing on improving runway incursion reporting and analysis with new tools and processes (such as the Surface RAP), we are better able to target our mitigation efforts. The Closed Runway Operation Prevention Device (CROPD) is a new technology that is being deployed to assist in the ATO's campaign to reduce runway incursions across the board.

Closed Runway Operation Prevention Device

Analysis carried out by MITRE Corporation revealed a significant increase in incursions on closed runways between 2009 and 2011. More recently, MITRE reported that landing clearances have been issued for closed runways on three separate occasions. As a result of these findings, MITRE and the ATO are developing CROPD, a system that uses speech-recognition technology to detect controller clearances, accepts controller input regarding which runways are closed, and generates an alert if the controller issues a clearance for a takeoff or landing on a closed runway.

In FY 2014, the FAA completed the approval and certification processes for CROPD and conducted field demonstrations of the system at Washington Dulles International Airport. The field demonstrations generated audio data and user feedback that will be used to improve the tool's design and concept.

Runway Excursions

In FY 2013 and FY 2014, runway excursions—in which an aircraft veers off or overruns a runway surface—resulted in one commercial air transport accident, four fixed-wing air taxi accidents, and 295 GA accidents, making them one of the most common types of accident in the NAS. Many different parties, from system designers, to pilots, to the airport authorities, have a hand in mitigating the possibility of these incidents.

Responding to the risk posed by runway excursions, the ATO has invested in a variety of prevention initiatives, compiling relevant data (much of which is made available to local facilities in near real-time) and sponsoring studies of aircraft energy states, runway overshoots, and rejected takeoffs, among other areas of concern.

In FY 2014, we completed the initial deployment of a runway excursion database. Although the ATO has maintained a runway incursion database for some time, this is the first database devoted to excursions; it represents an important step forward in the safety of our airport movement areas. We also made significant strides toward standardizing a runway excursion severity classification system and aligning that system with the latest developments in the ATO's common taxonomy.

Runway Excursion Website

In March 2014, as part of a runway excursion safety campaign, we launched a project developed in collaboration with the National Air Traffic Controllers Association (NATCA) and CANSO: a mobile device–friendly runway excursion website (Figure 18) designed to help educate controllers and pilots on the definition and causes of, risks involved in, and strategies for preventing runway excursions.
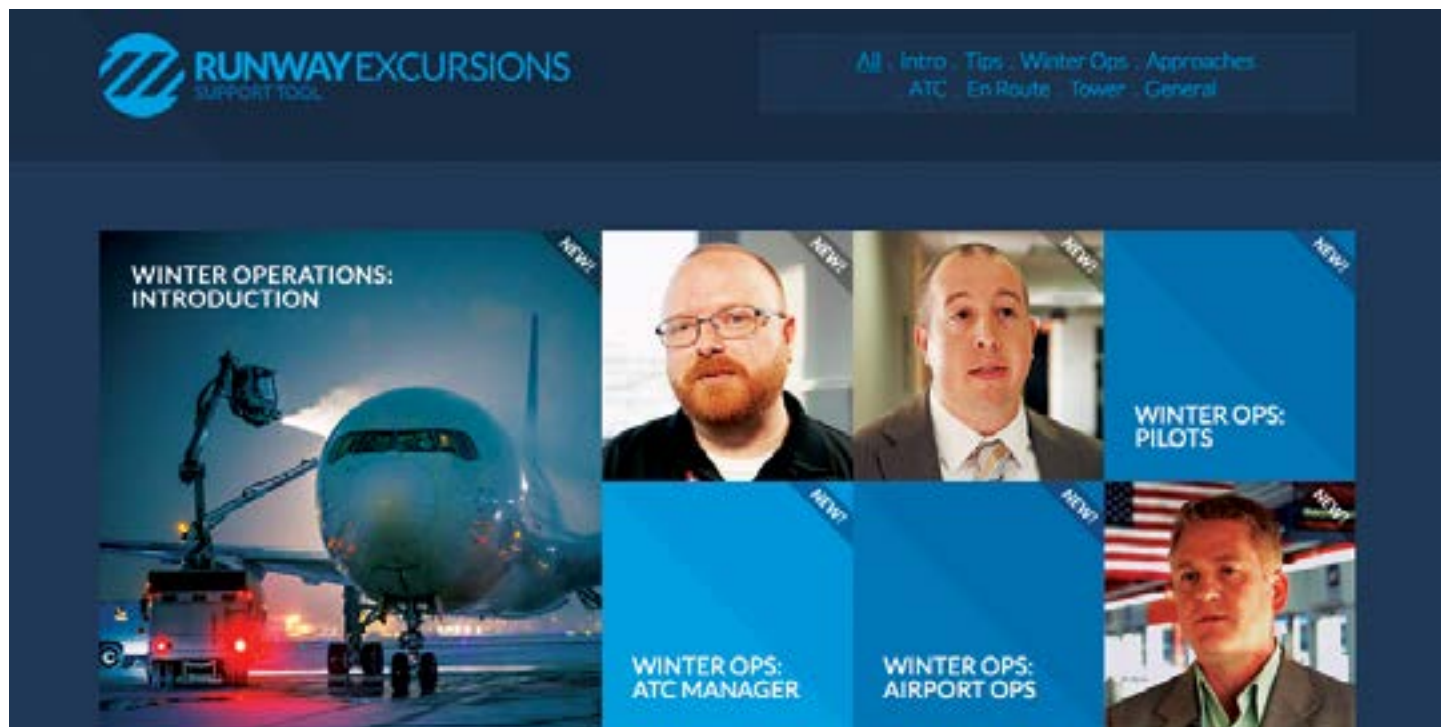

Figure 18: The ATO's Runway Excursions Website

Airport Construction Advisory Council

The Airport Construction Advisory Council (ACAC) is dedicated to ensuring the safety of all stakeholders operating in the NAS during all runway and taxiway construction projects. Toward that end, the ACAC develops strategies to enhance surface safety and the reliability of communications between controllers and construction crews. The ACAC also serves as a best practices conduit for managers throughout the NAS.

In FY 2014, the ACAC:

- Altered current ATO policy to require tower facilities to coordinate Notices to Airmen on declared distances whenever runways are shortened for brief periods (greater than one day) to conduct construction activities

- Implemented new ATO policy suspending instrument procedures on runways that have been closed or shortened for periods of more than 60 days

- Helped to clarify the distinction between a "relocated" threshold, which closes a portion of the approach end of a runway, and a "displaced" threshold, which is located at a point other than the runway's designated beginning
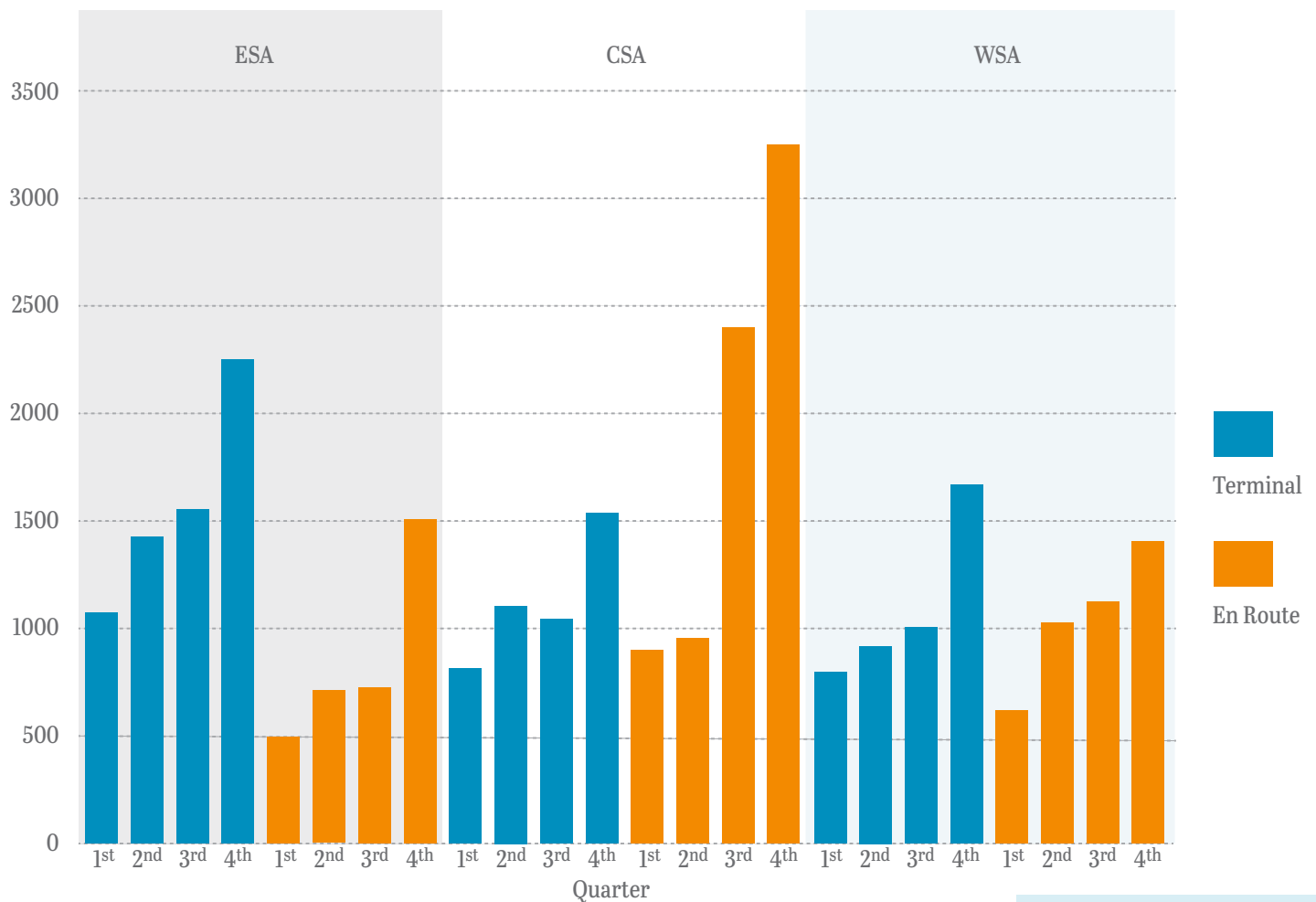
Figure 19: OSAs by Quarter, FY 2014

Compliance

To help us identify underlying or latent issues in the NAS, the ATO conducts Quality Control (QC) assessments in the field. These assessments—which address facility technical performance, systemic issues, and procedural compliance—are designed to generate data sets that provide a comprehensive picture of safety performance at and across NAS facilities. Analyses of these data lead directly to corrective actions.

Operational Skills Assessments

To further identify systemic issues, Operational Skills Assessments (OSA) sample the technical performance of our frontline personnel. They are designed to capture, as objectively as possible, technical performance and

not rate individual performance. Data gathered during OSAs are combined with other QC data for the purposes of safety trend analysis.

To provide a sufficiently large and consistent sample for trend analysis, facilities must perform an assigned minimum number of OSAs per quarter; the target is determined by the size of the facility. Figure 19 depicts total OSAs in FY 2014 conducted by air traffic facilities in each of the three Service Areas.
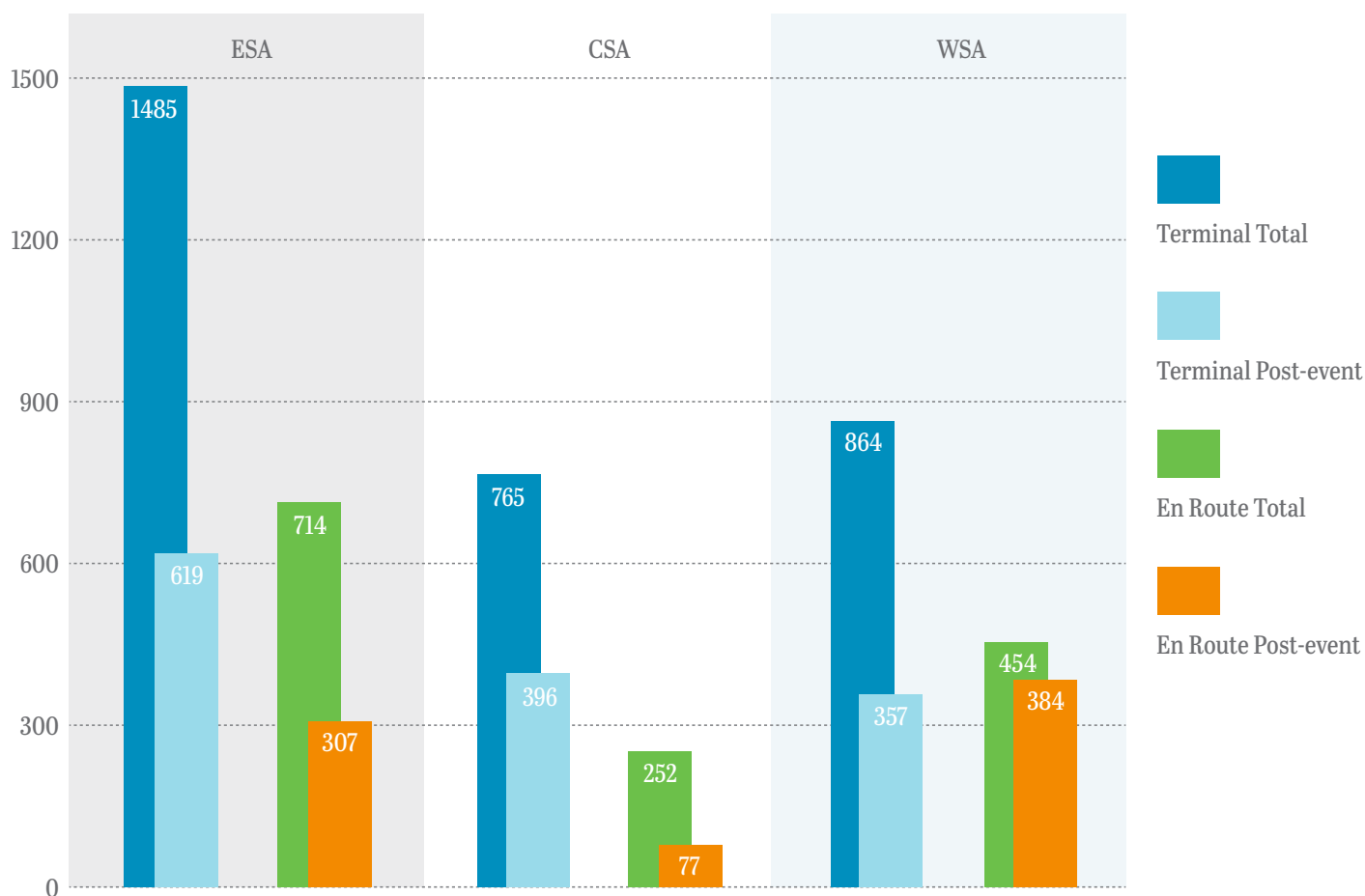
Figure 20: SSRs Conducted, FY 2014

System Service Reviews

The intent of a System Service Review (SSR) is to review the air traffic services provided in any situation, at any time, under any circumstances. SSRs may be performed at random, according to a schedule, in response to public inquiries, or following a safety incident. There is no set scope for SSRs—they may be highly specific, or evolve into large-scale and in-depth reviews, if warranted. SSRs provide facilities with defined procedures and a systematic approach to addressing safety issues at the local level (Figure 20).

Internal and External Compliance Verification

Compliance verification is a key element of the ATO's Quality Control efforts. Compliance verification includes direct operational observations, discussions with frontline personnel, and reviews of voice and radar data, among other activities. They are carried out by the facilities themselves (internal) and by independent auditors sent to the facilities by the Service Areas (external). In both cases, analysis of the evidence and deployment of any solutions are carried out in collaboration with the appropriate labor unions.

Should compliance verification result in the identification of issues, mitigation plans are enacted; of the 1,141 mitigation plans initiated in FY 2014, 390 have been closed, while 751 remain ongoing. At the close of FY 2014, a total of 911 mitigation plans, reflecting the last three years, remained open (Figure 21).
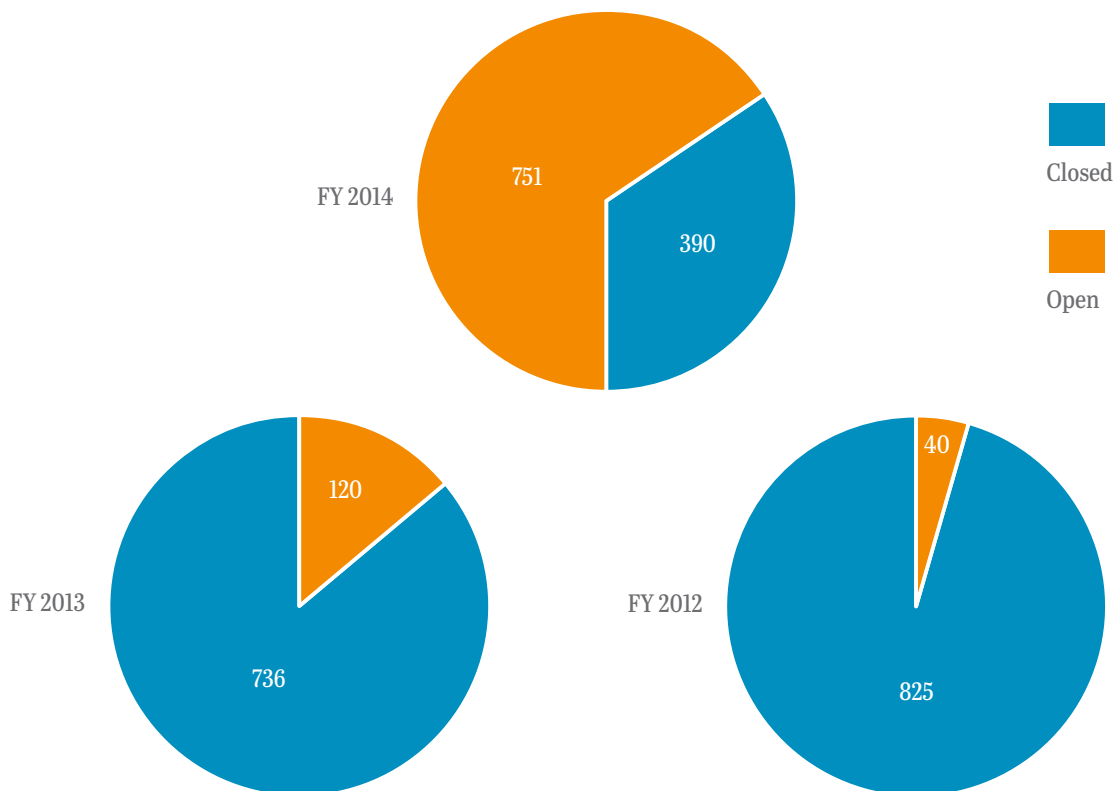
Figure 21: Status of FY 2012–2014 Mitigation Plans

Safety Intelligence

The digital era brings with it sophisticated data recording, analysis, modeling, and visualization tools that can be leveraged to achieve a better understanding of safety performance.

Investing in the development and implementation of these tools has allowed the ATO to aggregate an ever-increasing amount of safety performance data—data with the granularity necessary to discern, at a remarkable level of detail, the factors affecting air navigation safety (for example: weather, phase of flight, airport configuration) and, more importantly, the relationship of those factors to hazards. Learning from these data, we have begun to develop new ways of measuring and monitoring the safety performance of the NAS.

New Safety Metrics

Among the most important of our safety intelligence tools are new metrics against which we measure the safety of our services and new Key Performance Indicators (KPIs) by which we track operations critical to the success of our overarching mission.

ATO Fatality Metrics

There is no statistic more important to the ATO than the number of fatal accidents to which a deficiency in air traffic services contributed. The aviation industry generally measures safety performance in terms of accidents. To be consistent with the industry, the FAA has for many years measured aviation safety in terms of fatal accident rates, focusing on two primary metrics: 1) the rate of fatalities per 100 million persons on board commercial air carrier flights, and 2) the rate of fatal GA accidents per 100,000 flight hours. In FY 2014, the ATO began to track our own contribution to aviation accidents. Unlike the FAA's metrics, which do not distinguish accidents by causation, the ATO's metrics aggregate only those accidents for which the NTSB has identified deficient air traffic services as a causal or contributory factor. Since 2002, there have been 52 such accidents, one of which involved a commercial airline flight, and the remaining 51, GA flights (see Figure 6). Over the last 30 years, the rate of air carrier passenger fatalities has declined significantly, as have those in which air traffic service deficiencies played a role (Figure 22).

The ATO examines the NTSB's reports on these accidents, along with data from our own investigations and other sources, to understand the hazards that lead to accidents and prevent those hazards from recurring.
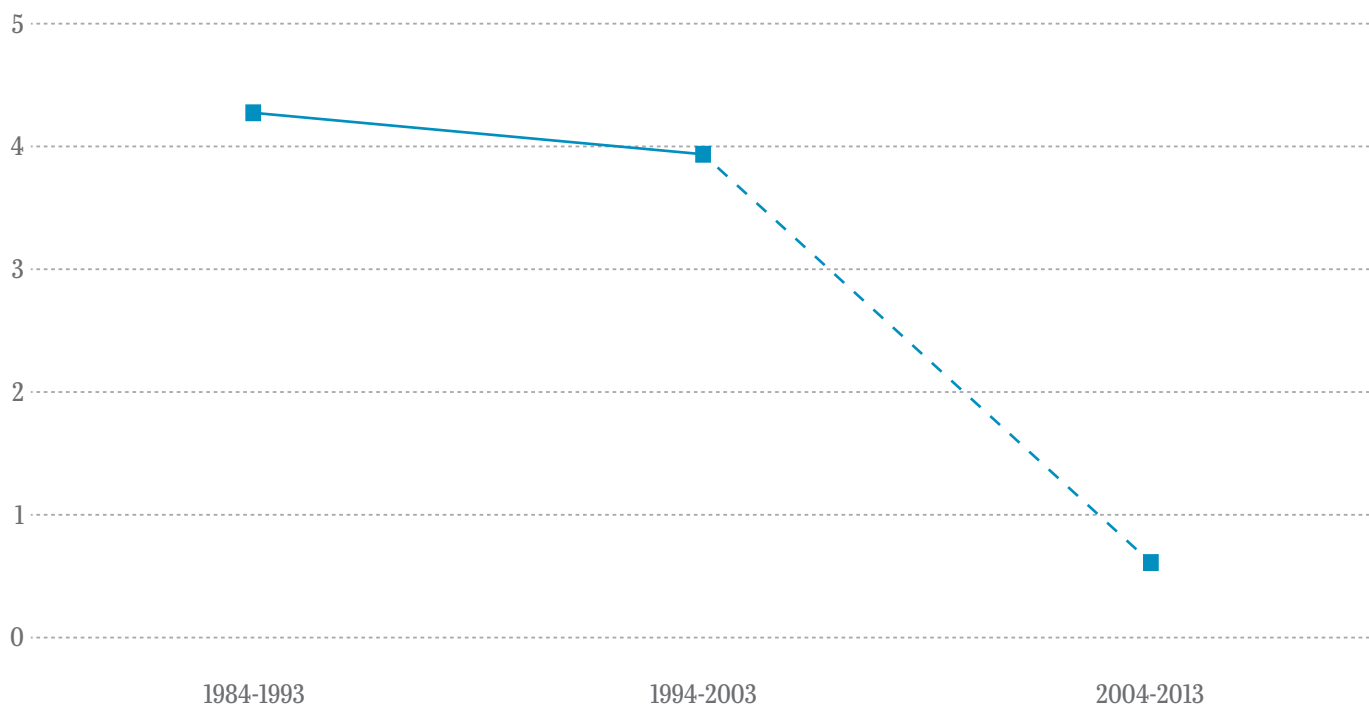
Figure 22: Rate of ATM-related Fatalities per 100 Million Passengers, CY 1984–2013

Loss of Control

7
18

CFIT

2
15

Mid-air Collision

2
4

Other Accidents

1
3

Weather Information

Terrain Alert

Traffic Alert or Advisory

Other
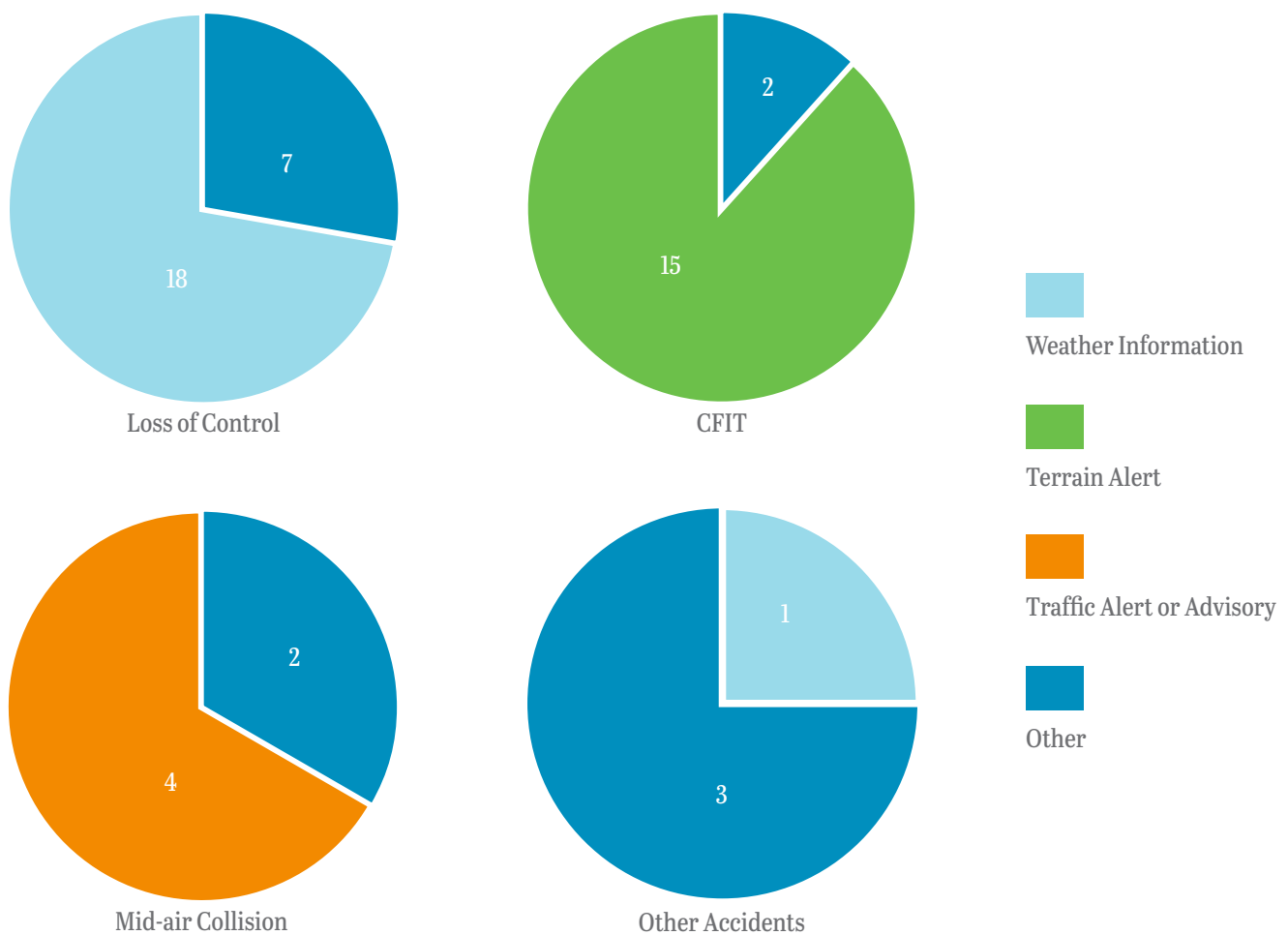
ATO Service Deficiencies

Development of the ATO's fatality metrics revealed not only the frequency of ATM-related accidents, but also the types of accidents to which the ATO contributed and the specific service deficiencies associated with those accidents. Over 90 percent of the accidents fit into one of three categories: loss of control, controlled flight into terrain (CFIT), or mid-air collision. For each category, most of the accidents were caused by a single service deficiency (Figure 23). Moreover, the three main service deficiencies share a common feature: failure to provide adequate information to the pilot about weather, terrain, or other aircraft. None of the accidents was due to a violation of the separation minima that controllers are required to ensure.

Analysis of our service deficiencies feeds critical safety decisions at the highest level of the ATO, including our CAR/CAP process and the annual Top 5. As a result of the current data, we have developed an enhanced prototype of the Airborne RAP that will allow examination of incidents associated with terrain proximity and selected the dissemination of weather information as an FY 2015 Top 5 hazard.

Key Performance Indicators

Working with MITRE, the ATO is developing algorithms that, fed with "threaded" track data (which merge input from surface and ground automation systems, operational safety databases, and flight tracking systems), are capable of monitoring the operational parameters that define our Key Performance Indicators (KPI) throughout the NAS. In FY 2014, the ATO focused on 20 algorithms, 12 of which have now been completed and fully deployed; their outputs populate our executive dashboards, which provide real-time overviews of safety trends in the NAS, and our analyst dashboards, which allow closer examination of individual facilities or events.

Our safety dashboards allow us to easily see the frequency and location of specific types of operations or incidents in the NAS (and thus monitor the effectiveness of our mitigation strategies), or "drill down" to review the details and context of a particular incident. The visualizations currently online depict data related to missed approaches, high-energy approaches, overshoots, and Opposite Direction Operations (ODO), among other areas. A relevant subset of these dashboards is accessible by field personnel via Local Safety Councils established by the Partnership for Safety program.

The following three examples—CRO, ODO, and Focus Airports—show the ways in which the ATO is using KPIs to identify issues and improve safety performance.

Converging Runway Operations

One of our KPIs, designed to monitor Converging Runway Operations (CRO) (Figure 24), provides an excellent example of the potential of our deployed KPIs and the promise of those under development.
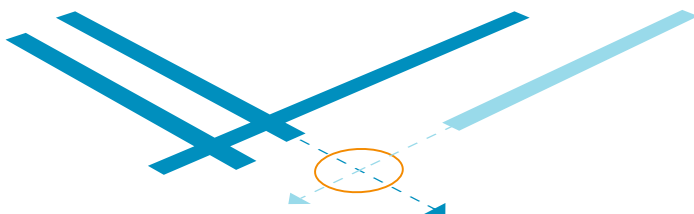

Figure 24: Converging Runway Operations

In 2011, during an investigation of go-arounds—that is, aborted landings executed while on final approach to a runway—the ATO discovered an issue related to CRO: specifically, situations in which the flight paths of go-around and departing aircraft posed a risk of violating required separation minima or colliding. These situations are possible at facilities where takeoff and landing operations are conducted independently on non-intersecting runways with converging flight paths.

The dimensions of the issue were further clarified thanks to KPI work undertaken jointly by the ATO and MITRE. Using four years' worth of surveillance and aeronautical data, we developed a simulation that helped us determine which specific scenarios pose the most risk.
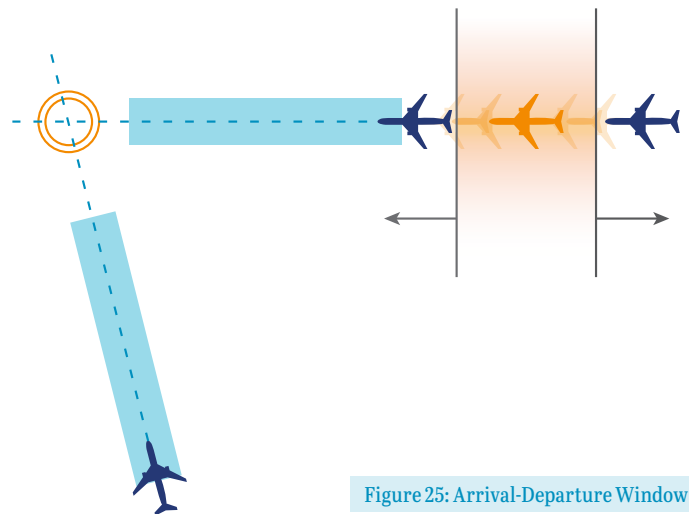
Figure 25: Arrival-Departure Window

Armed with a thorough understanding of the issue, we repurposed that same simulation model, first, to develop a CRO KPI (which is now available on our dashboards) and, second, to create a site-specific software tool known as the Arrival-Departure Window (ADW) (Figure 25). The ADW is a graphical box, displayed on controllers' monitors, that demarcates an area between one and three nautical miles from a runway's threshold. Its purpose is to indicate to controllers when it is safe to release aircraft for departure—that is, only when there are no arrivals within the ADW.

The ATO's CRO work also led to policy changes requiring that CRO be conducted dependently and that every impacted facility specify when and how intersecting runway separation standards should be used to ensure go-arounds do not conflict with departures. The ATO received a Department of Transportation Secretary's Award and a CANSO IHS Jane's ATM Award for its work in 2014 in mitigating risk in Converging Runway Operations.

Opposite Direction Operations

In the summer of 2012, a loss of required separation at Ronald Reagan Washington National Airport drew heavy media attention; the incident involved Opposite Direction Operations (ODO), a routine operation in which landings and takeoffs are conducted reciprocally in opposite directions on the same runway. A similar event occurred that same day at Birmingham International Airport. ATO investigations revealed that while the facilities had ODO procedures, they were inconsistent—in fact, the NAS as a whole lacked standardized ODO procedures. In response to this situation, the ATO temporarily suspended ODO, and in early 2013, published an order and a notice standardizing national ODO policy.

Unfortunately, monitoring results showed that the new policy was ineffective. To understand the problem more thoroughly, the ATO and MITRE developed an ODO detection algorithm and, by running four years' worth of threaded track data through it, identified more than 2,000 ODO events. This research informed new mitigation strategies in FY 2014, including the establishment of ODO cutoff points (minimum distances for the safe conduct of ODO), procedures requiring the issuance of ODO traffic advisories to both involved aircraft, and the development and use of a memory aid for air traffic controllers. With this new KPI, the ATO is monitoring the effectiveness of these mitigations in real time as they are rolled out.

ODO Dashboard

Figure 26 represents one of the ATO's ODO dashboards. It depicts the status of ODO events by runway; each square represents a runway at a specific airport. The size of the square indicates the number of ODO events and the color, the most severe ODO event at that runway. Each square on the dashboard is labeled with the airport identifier, runway name, and number of ODOs. An analyst can select an airport from the heat map to bring up additional views with event-specific information, including: aircraft identification, departure/arrival runways, time-of-event, vertical/lateral separation, altitude profiles, ground speed, aircraft track position, and more.

Airport	XYZ
Runway	RWY12
Number of ODOs	30

Figure 26: Heat Map Visualization of ODO Data

Focus Airports

In FY 2014, the ATO established the Runway Safety Focus Airports Program, an initiative intended to use objective data to identify the airports in the NAS that require focused, proactive attention. To determine and rank these airports, the program brings together observed events (actual, measured events in the NAS, such as the number of runway incursions) drawn from the KPIs, warning indicators (such as reports and requests for assistance), and latent factors (such as planned procedural changes or airfield construction projects that could impact safety).

We used 15 hierarchically organized and weighted metrics to examine 64 airports, ultimately identifying 20 whose specific issues will be addressed in FY 2015 (Figure 27).

In the coming years, the ATO plans to subject all towered facilities in the U.S. to the Focus Airports process.
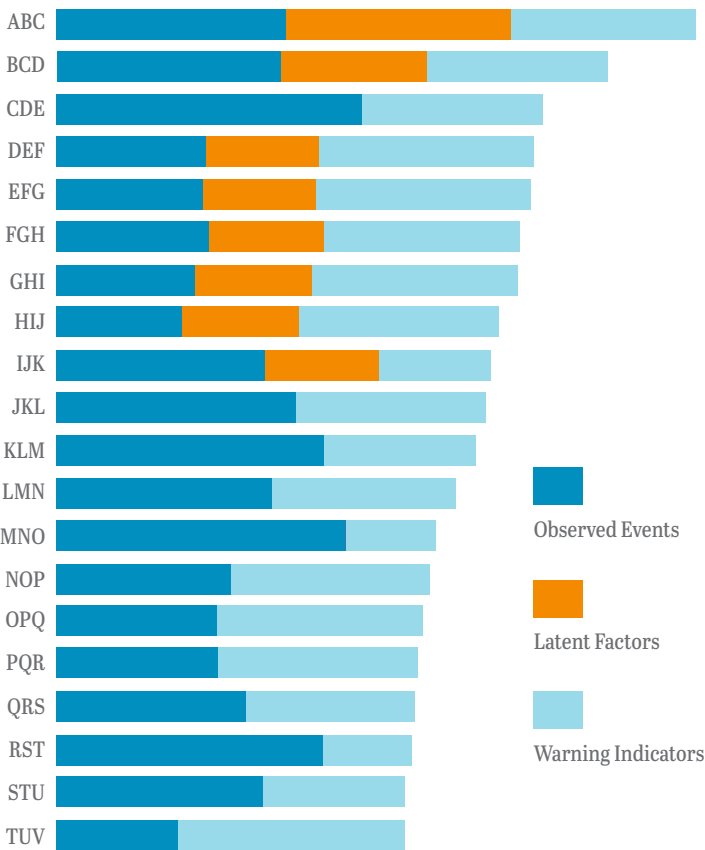

Figure 27: Weighted Risk Factors for FY 2015 Focus Airports

Digital Safety Tools

Over the past several years, the ATO has refined or developed a variety of digital safety tools designed to support our safety risk management activities, including our metrics. Some are responsible for collecting the data necessary for thorough analysis, some for aggregating and making accessible those data, and some for representing, for the purposes of trend analysis and education, the incidents to which the data pertain. All, however, are critical to ensuring the safety of the NAS and preparing us for the future of air traffic safety.

Comprehensive Electronic Data Analysis and Reporting

The Comprehensive Electronic Data Analysis and Reporting (CEDAR) tool, which aggregates automated and mandatory reports pertaining to safety incidents and then makes those reports available to safety analysts, underwent several significant enhancements in FY 2014, including the following:

- Federal contract towers now have the ability to submit occurrence reports to CEDAR.

- NAS-wide emphasis items addressing facility performance can now be assigned and tracked in CEDAR.

- The development and progress of CARs and CAPs can now be tracked in CEDAR.

- Events logged in CEDAR can now be searched by category (for example, ODO or Unmanned Aircraft Systems).

These enhancements serve both of CEDAR's primary user groups: frontline personnel can submit more data, and can do so more easily than previously possible, and safety analysts have new, more powerful tools to help them sift through those data.

Falcon

Falcon, the ATO's primary events playback tool (used for training, incident review, and forensic purposes), received a number of enhancements in FY 2014. Falcon users now have the ability to:

- Replay automation data saved in other file formats

- Add timeline tags to highlight events

- Create replays of up to eight hours in length in near real-time

- View Conflict Alerts or Minimum Safe Altitude Warnings at certain Terminal facilities

- Transfer control of saved replays

Digital Audio Legal Recorder Remote Audio Access System

The Digital Audio Legal Recorder Remote Audio Access System (DRAAS) allows the ATO to access audio recordings of operational communications from across the NAS and automatically synchronize those recordings with visual replays captured and stored by other systems. In FY 2014, we completed testing of DRAAS at the Mike Monroney Aeronautical Center in Oklahoma City and brought the total number of facilities connected to the system to 120.

Search and Rescue

The ATO uses forensic radar tools to help locate aircraft that are the object of an active search and rescue mission. Among the newest of these is the Aircraft Search Tool, which was developed in FY 2013 and deployed in FY 2014. Hosted in CEDAR, the tool allows users to easily find an aircraft's last known position using radar track data and displays additional tracks within a 40-mile radius or 10-minute window of the target track's last radar return. The tool also provides access to facility, sensor, latitude/longitude, speed, beacon code, call sign, and altitude information.

As data become available, the Aircraft Search Tool will incorporate data from other surveillance sources, including the Airport Surface Detection Equipment Model X, Automatic Dependent Surveillance–Broadcast, and Micro En Route Automated Radar Tracking systems.

In FY 2014, the ATO conducted a comprehensive review of search and rescue missions to ensure that we are responding to incidents in a timely fashion; we also developed a number of search and rescue mission awareness training products, including recurrent training and articles detailing the roles and responsibilities of those involved.

Forensic Event Animation

Applying computational forensics, the ATO in FY 2014 produced 30 animated "lessons learned" in response to specific air traffic control–related incidents. By combining available operational and contextual data, these animations provide accurate depictions of the events as they unfolded, reinforcing controller training and incident review efforts.

As the uses of computational forensics expand—to include controller performance lessons, pilot performance predictions, and system performance within the air traffic control environment—the ATO's forensic animations are being made more widely accessible to our facilities. An online media library, currently consisting of 85 events, has been created and includes detailed, narrative labels designed to help facility training specialists find the animations they need.

Safety Management System

As we deploy the technologies and infrastructure that will comprise the Next Generation Air Transportation System (NextGen), the resulting changes to the NAS require an intensive and systematic approach to safety.

The ATO uses a Safety Management System (SMS)—an integrated collection of concepts, processes, and tools—to achieve this. The SMS establishes the principles that undergird our cyclical approach to the management of risk: collect operational data, analyze the data, address any risks identified, and repeat.

SMS 4.0

One of our most significant accomplishments in FY 2014 was the publication and full implementation of our new SMS. This required that we train our personnel and communicate the significance of the new system throughout the organization. Two years in the making, SMS 4.0 boasts a more conservative approach to risk assessment (Figure 28) and a set of safety performance targets more closely aligned with our recent infrastructural and data analysis advances, both of which will improve the consistency and precision with which we measure risk.

SMS Maturity

Also in FY 2014, we took a comprehensive look at the maturity of our SMS for the first time since its implementation in 2010. To accomplish this, we relied on an SMS maturity level model developed by CANSO and aligned with the global SMS requirements of the International Civil Aviation Organization (ICAO). The model divides SMS maturity into five levels (Figure 29) and 17 elements—such as Safety Policy, Safety Accountabilities, and Training and Education; the elements themselves contain 33 specific objectives.

The ATO gathered evidence from every corner of the organization and, after much analysis, determined that, in almost all of the areas assessed, our SMS had attained the highest maturity level possible in CANSO's model, that of Continuous Improvement. In only three of the 17 SMS assessment areas is the ATO still working toward Continuous Improvement (see Figure 2).

Severity / Likelihood	Minimal 5	Minor 4	Major 3	Hazardous 2	Catastrophic 1
Frequent A	Low	Medium	High	High	High
Probable B	Low	Medium	High	High	High
Remote C	Low	Medium	Medium	High	High
Extremely Remote D	Low	Low	Medium	Medium	High
Extremely Improbable E	Low	Low	Low	Medium	Medium / High

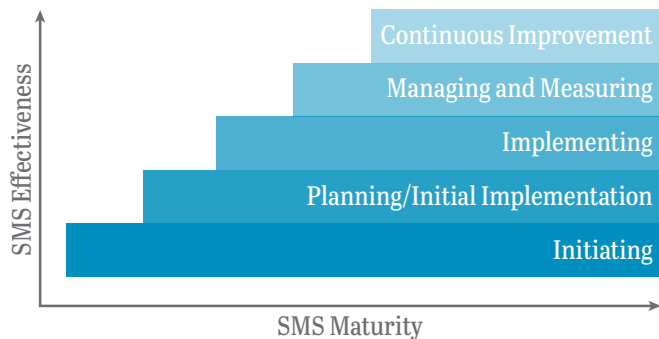Figure 28: More Conservative SMS Risk Matrix

Figure 29: CANSO SMS Maturity Levels

Safety Management Tracking System

With the increasing complexity of the NAS comes the need for consistent and widely available safety data. To ensure that we have at our fingertips and are using effectively as much information as possible, the ATO has deployed a web-based Safety Management Tracking System (SMTS). Designed from the ground up to complement SMS 4.0, the SMTS will serve as the ATO's system of record, a living repository for our hazard and risk analysis data.

In its current iteration, the SMTS automates the collection and tracking of data generated by safety analysis activities related to NAS changes, enforces the standardization of those data, and allows their access by users anywhere in the country. Future releases will integrate safety processes that, at the moment, are either performed manually and stored in disparate locations, or performed in inconsistent standalone applications.

Launched in September 2014, the SMTS gained over 100 users working together on more than 40 safety cases in its first month of use. Once we have amassed a sufficiency of integrated data, the SMTS repository will be analyzed for trends and real-time data visualizations will be made available, facilitating more comprehensive and efficient safety performance monitoring than ever before possible.

Safety Programs

The quality of the ATO's safety programs is measured by their success in addressing deficiencies and improving safety performance. The programs discussed in this section are highlights among many initiatives driven by the ATO's recursive corrective action process, by which—with the help of our digital tools, VSRPs, RAPs, audits, assessments, etc.—safety issues are identified, managed, and monitored.

Partnership for Safety

Launched in 2010, the Partnership for Safety (PFS) has expanded considerably, becoming an integral part of our efforts to manage safety. The PFS enables local management and union representatives to establish Local Safety Councils tasked with identifying and mitigating safety issues at the facility level. The work of the Local Safety Councils, their lessons learned, and feedback are documented on and disseminated via ATC InfoHub, a safety information portal available on the PFS website. Thanks to the PFS, successful risk mitigation techniques are being shared with and adopted by similar facilities.

In FY 2014, the PFS completed its training plan, establishing Local Safety Councils at all 315 FAA-staffed facilities in the NAS.
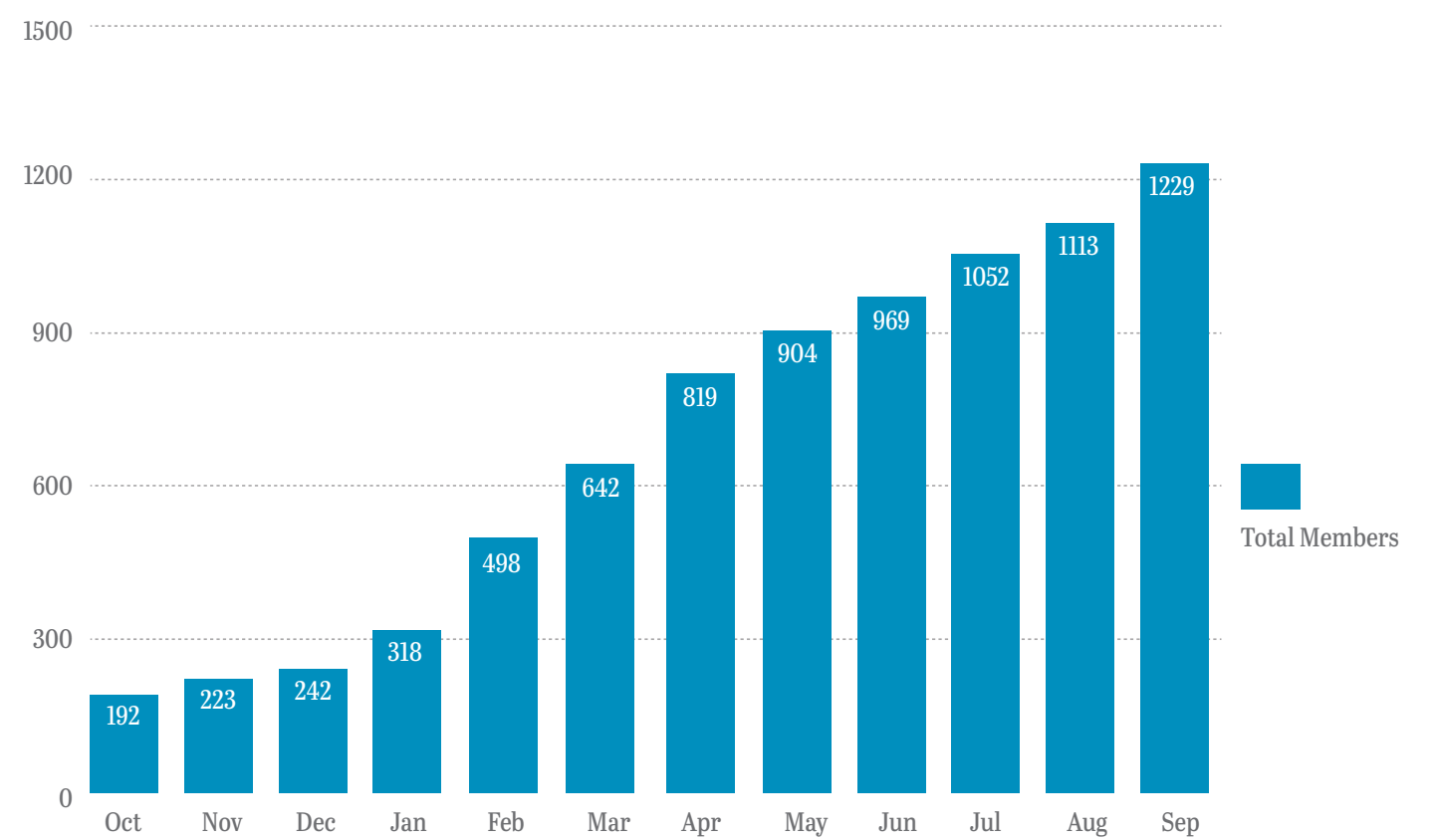

Figure 30: Number of Personnel Active in Local Safety Councils, FY 2014.

Also in FY 2014, enhancements were made to the PFS website, ATC InfoHub, and the PFS Portal, where safety data are collected and made available in near real-time for analysis by Local Safety Councils. Allowing the councils to respond quickly to their own safety needs, the PFS Portal provides data pertaining to:

- Missed approaches
- Traffic Alert and Collision Avoidance System resolution advisories
- Mandatory reporting trends
- ATSAP trends
- High-energy approaches
- Sector traffic
- Runway overshoots
- Arrival winds
- Facility weather conditions
- Similar-sounding call signs

Fatigue Risk Management

Managing fatigue and maintaining alertness on the job is a shared responsibility. Not only must personnel take advantage of sleep opportunities, getting the restorative rest they need to be fully charged on duty, but ATO management and the labor unions must mitigate fatigue hazards associated with work schedules and update procedures to promote alertness. Only by working together can we practice effective Fatigue Risk Management (FRM), ensuring the availability and safety of our air traffic control services.

Technical Operations Fatigue Risk Management

During FY 2014, the ATO developed a series of fatigue mitigation strategies specifically tailored to the needs of our frontline technicians. These included limiting work periods (to reduce the risk of poor cognitive performance due to extended wakefulness) and developing a fatigue training course adapted with the help of fatigue scientists from training originally designed for airline maintenance workers.

The objectives of the course, which is required for both air traffic controllers and technicians, are to correct misperceptions about fatigue, promote awareness of the negative impacts of fatigue, and recommend fatigue-risk countermeasures. Pre-and post-course evaluations indicated that attendees' knowledge of FRM improved an average of 25 percent.

Midnight Shift Alertness

In FY 2014, the ATO, NATCA, and the Professional Aviation Safety Specialists (PASS) collaborated in an important effort to address the fatigue risks associated with midnight shifts. Data drawn from ATSAP, the National Aeronautics and Space Administration Controller Alertness and Fatigue Monitoring Study, and ATO operations indicated that 10-hour midnight shifts, consecutive midnight shifts, and early day shifts that precede midnight shifts are associated with the highest risk of fatigue. With the help of fatigue scientists, the workgroup explored the two key factors that increase fatigue during these types of shifts (circadian rhythm and accumulated sleep debt) and developed recommendations to help ensure that controllers remain alert during midnight shifts, especially when working alone.

The recommendations included eliminating or restricting certain shift schedule patterns (such as consecutive midnight shifts, early day shifts preceding a midnight shift, and hold-over overtime) and requiring controllers to positively accept receipt of an aircraft into their airspace before transferring controllers may relinquish control of it. When fully implemented, these safety provisions will bring about measureable reductions in the prevalence of fatigue risk throughout the NAS and constitute an important step in the development of a stronger, system-wide safety culture.

Safety Promotion

Essential to the effectiveness of our SMS, the ATO's safety promotion efforts ensure that our personnel are aware of the organization's commitment to safety, any issues or trends that may affect their work, and the safety systems and processes available to them.

In FY 2014, both components of safety promotion—communication and training—made significant contributions to the improvement of our safety culture.

Communication

In FY 2014, the ATO raised the bar for communicating and promoting safety. All Points Safety, our ongoing education and awareness initiative, continues to recognize and educate operational employees on proactive safety programs and initiatives. Additionally, we expanded our established communications campaigns designed to proactively address safety issues, including:

- Top 5 safety hazards
- Fully Charged, a joint campaign sponsored by the FAA, NATCA, and PASS to promote fatigue awareness by providing the workforce with tools to self-educate and mitigate fatigue hazards
- Turn Off Tune In, a joint campaign with NATCA to increase awareness and education about the safety impact of distractions, particularly electronic distractions, to controllers and managers in the operational environment

Recurring publications, such as Safety Matters and Safety and Technical Training eNews, promote specific safety achievements, encourage personnel to participate actively in our safety culture, and spread valuable lessons learned throughout the agency. The ATO's portfolio includes print and electronic media ranging from one-page operational safety bulletins to comprehensive websites and videos that are accessible by mobile devices, all designed to ensure that our employees' safety practices are current and thoroughly informed.
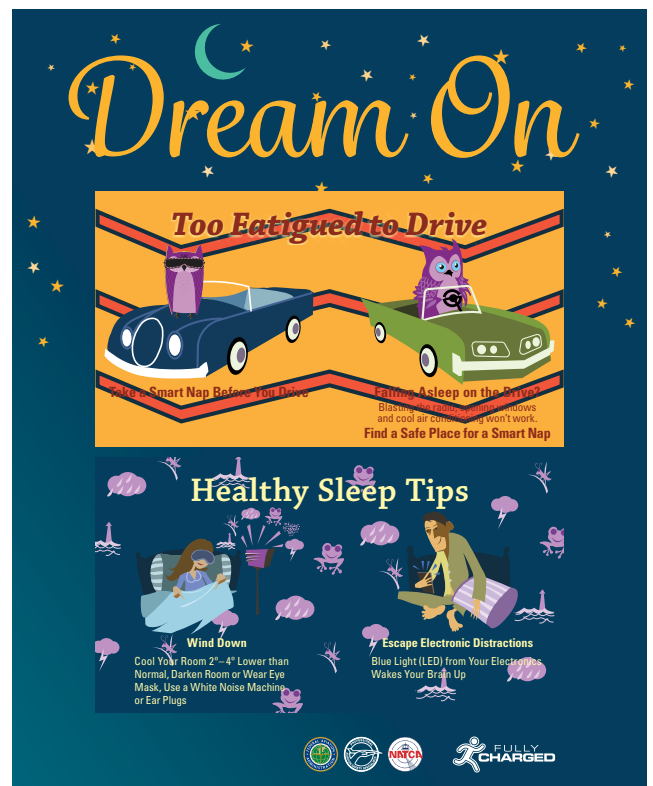
Recurrent Training

Recurrent training is a nationwide curriculum that provides instructor-led and web-based courses to air traffic controllers. Developed collaboratively with NATCA, it is updated and delivered twice per year and is designed to increase controllers' proficiency, enhance their awareness of the human factors that affect aviation, and promote the behaviors necessary to identify and correct risk.

Now in its third year, recurrent training has evolved to reflect the growth and maturity of our SMS. Early iterations focused on foundational topics such as safety culture, conflict resolution, and winter weather. As our SMS has evolved, the focus has turned toward mitigating the hazards identified through such programs as ATSAP, PFS, RAP, Quality Assurance (QA), and QC. Using the data collected by these programs, as well as input from the Top 5 and national CAR/CAP process, we determine which topics to address in training. FY 2014 topics included:

- Weather dissemination
- Hazards and challenges associated with on-the-job training
- Combining and de-combining positions

Just as the training content has evolved, so have the discussions in the recurrent training workshops. In these workshops, controllers can discuss safety topics, reflect on real-life scenarios at their facility, apply safety culture principles, and share lessons learned and best practices. Recent discussions demonstrate that controllers are becoming more proactive and preemptive in their approach to ATM, and course feedback indicates that controllers find the data-driven curriculum more relevant and applicable to their everyday jobs.

Recurrent training has become a prominent feedback loop that returns valuable lessons learned to the front lines and contributes to mitigating risk in the system.

Global Leadership

The ATO provides international leadership in ATM by working closely with international partners—such as ICAO, CANSO, and EUROCONTROL—and other industry-leading air navigation service providers—such as NAV CANADA, UK NATS, and Airservices Australia. Together, our focus is the global harmonization of safety management practices.

Toward that end, in FY 2014, ATO personnel served as the CANSO Safety Program manager, supported the CANSO Safety Standing Committee, and contributed to many international workgroups, including the Commercial Aviation Safety Team–ICAO Common Taxonomy Team, the ICAO Runway Safety Partnership Team, and the ICAO/International Air Transport Association KPI Working Group. The ATO is also a member (along with UK NATS and Airservices Australia) of the Trilateral Workgroup, which collaborates on the development of leading indicator concepts and risk assessment methodologies.

To share our best practices and lessons learned with our global partners, we regularly attend international forums (annual CANSO and ICAO safety conferences, for example). In FY 2014, we were solicited for and shared our knowledge of VSRPs, FRM, and runway safety with NAV CANADA, Airservices Australia, and the Air Traffic and Navigation Services of South Africa, respectively.

Recovery

In FY 2013, while working to establish the FY 2014 Top 5, the ATO discovered that recovery is associated with 73 percent of all high-risk events in the NAS. Recovery describes any operational action taken—or not taken—by a controller in an attempt correct an unsafe situation. As a result of this analysis, recovery became a topic of recurrent training.

Future Systems

As demand for our nation's airspace continues to grow, the FAA is rolling out a variety of new technologies and techniques (collectively referred to as NextGen) intended to meet that demand.

By providing more precise tracking and routing of aircraft, NextGen promises to enhance safety, reduce delays, and save fuel. The ATO is paving the way for these systems by ensuring that our on-the-ground procedures and approach to safety management reflect the latest changes to the NAS and anticipate its future transformation.

Revising the Air Traffic Control Handbook

In FY 2014, a team of representatives from the ATO, NATCA, and commercial airlines updated the Air Traffic Control Handbook (FAA Order JO 7110.65). Their revisions served two purposes: to update or clarify existing procedures and to lay groundwork that will facilitate the implementation of NextGen technologies. Revisions touched on the following sections of the manual:

- Approach Preference/Vertical Guidance, which now suggests an order of preference for approaches that provide vertical guidance: preference is given to available precision approaches, followed by non-precision approaches with vertical guidance, and, finally, all other non-precision approaches

- Pilot Acknowledgement/Readback Requirements, which now clearly defines the roles of both pilots and controllers, and harmonizes FAA orders

- VFR to IFR Flights, which now requires controllers to ask pilots seeking pop-up IFR clearance if they are able to maintain their own terrain and obstruction clearance until reaching the appropriate altitude

- Wake Turbulence Application, which now requires En Route controllers performing Terminal functions to provide the same wake turbulence separation standards

The team also published the second annual Air Traffic Control Revision Project Implementation Strategy Report, which describes in detail the FY 2014 Handbook revisions and the expected safety benefits of each change.

Integrated Safety Management

With NextGen, the NAS is transitioning from a large group of standalone systems to a system of systems. The interactions and dependencies inherent to this system of systems must be managed to prevent elevated safety risk. Existing safety risk management processes require safety assessments for individual elements of the NAS, but may not consider the interdependencies of those elements. The Integrated Safety Management (ISM) methodology builds on current risk management processes, filling the safety gaps that arise from interacting and dependent systems. By assessing a higher-level grouping of systems, ISM can identify, assess, and provide information about hazards that arise between or among systems. The early identification of hazards at all system levels improves our ability to manage, minimize, or eliminate safety risks.

Integrated Safety Assessment Model

One of the safety analysis methods that the ATO is developing in parallel with NextGen is the Integrated Safety Assessment Model (ISAM). The ISAM has two goals: to provide the risk baseline of the current NAS and forecast the risk posed by any changes to it (for example, the implementation of any NextGen technologies). The ISAM is an application and extension of two air transportation system safety models: Delft University's Causal Model for Air Transportation Safety and EUROCONTROL's Integrated Risk Picture.

The ISAM Version 1.0 was released in September 2014. Now a web-based tool, the site hosts models of the key components of the NAS that affect the safety risk baseline. In Version 1.0, the results of two important studies (Time-based Flow Management and Tower Flight Data Management) were incorporated into the overall risk prediction. ATO-specific accident scenarios, known as Event Sequence Diagrams (ESD), will continue to be added to the ISAM and their risk quantified using data from the Aviation Safety Information Analysis and Sharing program, Flight Operations QA, NTSB accident reports, and surveillance systems. To date, 34 quantified ESDs have been included in the ISAM.

Audits and Assessments

Audits and assessments, an integral part of our SMS, are conducted for the purposes of ensuring that our new technologies and procedures are safe for national deployment, that any existing or new safety hazards related to those technologies and procedures are identified, and that safety management practices at all levels are aligned with FAA policy. The ATO conducted 27 such activities during FY 2014, including:

- Five Independent Operational Assessments, all of which evaluated the suitability and effectiveness of NextGen technologies

- 10 Technical Operations Assessments, designed to determine whether training issues were resolved, flight inspection procedures followed, and Instrument Landing Systems properly maintained

- 12 Air Traffic Control Audits, touching on CRO, helicopter operations coordination, and arrival sequencing (an FY 2012 Top 5 safety hazard), among other topics

Moving Forward

The ATO's vibrant Safety Management System stems from a safety culture that, in FAA Administrator Michael Huerta's words, is embodied in our professionalism and dedication to the American public to provide the safest and most efficient airspace system in the world.

Our investments in new safety technologies and safety improvement programs have created the tremendous positive momentum of our proactive safety culture. These investments—in people, processes, and technology—are moving us toward increasingly adaptive and anticipatory approaches to safety, expanding our understanding of the factors that contribute to or mitigate safety hazards, and deepening our knowledge of the relationship between safety activities and their outcomes.

As the NAS continues to expand and move forward, and as we implement NextGen, the ATO is committed to seeing that we do so in the safest and most efficient way possible.

Figure 31: ATO Safety Goals and Activities, FY 2015

Goal	Associated Activities
Build on safety management principles to proactively address emerging safety risk by using consistent, data-informed approaches to make smarter, system-level, risk-based decisions.	• Develop functional requirements and competencies for safety data and risk analytics workforce and identify current personnel with relevant skills. • Establish common data taxonomies to be used consistently across the FAA, with industry, and internationally. • Align modeling assumptions in systems that simulate and predict NAS safety risks. • Establish an agency-wide tool to track hazards and mitigation outcomes.
Enhance decision-making process.	• Develop and implement processes to identify safety hazards of planned changes in the aerospace system. • Identify cross-organizational hazards and utilize current policies and guidance material to assess the associated risk; modify policy to reflect lessons learned; and complete process for identifying hazards.
Lay the foundation for the NAS of the future by achieving prioritized NextGen benefits, integrating new user entrants, and delivering more efficient, streamlined services.	• Deliver key foundational, high priority, and transformational programs. • Develop and refine procedures and perform the requisite analyses for closely spaced, parallel runway operations in reduced visibility weather conditions; include separation procedures for dependent, simultaneous independent, and paired parallel instrument approaches.
Safely and efficiently integrate new types of operations, such as commercial space and unmanned aircraft, into the NAS and enable the benefits these operations will provide.	• Continue Unmanned Aircraft System (UAS) integration efforts with development of UAS-related policies, processes, documents, and procedures. • Partner with the Office of Commercial Space Transportation to demonstrate and document processes for the safe integration of commercial launch and reentry operations into the NAS. • Explore the feasibility of a space traffic management capability.

Resources

- Federal Aviation Administration Air Traffic Organization, Annual Air Traffic Safety Action Program Executive Committee Report, 2014

- Federal Aviation Administration Air Traffic Organization, ATO Safety Dashboards, 2013 and 2014

- Federal Aviation Administration Air Traffic Organization, Fiscal Year 2014 ATO Business Plan, 2014

- Federal Aviation Administration Air Traffic Organization, Fiscal Year 2014 Closeout Simplified Program Information Reporting and Evaluation Report, 2014

- Federal Aviation Administration Air Traffic Organization, National Runway Safety Plan 2015–2017, 2014

- Federal Aviation Administration Air Traffic Organization, Runway Excursion Data Report, 2014

- Federal Aviation Administration Air Traffic Organization, Safety Matters, 2013 and 2014

Acronyms

Acronyms	
ACAC	Airport Construction Advisory Council
ADW	Arrival-Departure Window
ASAP	Aviation Safety Action Program
ATM	Air Traffic Management
ATO	Air Traffic Organization
ATSAP	Air Traffic Safety Action Program
CANSO	Civil Air Navigation Services Organisation
CAP	Corrective Action Plan
CAR	Corrective Action Request
CBM	Columbus Air Force Base
CEDAR	Comprehensive Electronic Data Analysis and Reporting
CFIT	Controlled Flight into Terrain
CISP	Confidential Information Share Program
CRO	Converging Runway Operations
CROPD	Closed Runway Operation Prevention Device
CY	Calendar Year
DRAAS	Digital Audio Legal Recorder Remote Audio Access System
ESD	Event Sequence Diagrams
FAA	Federal Aviation Administration
FRM	Fatigue Risk Management
FY	Fiscal Year
GA	General Aviation
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ISAM	Integrated Safety Assessment Model
ISM	Integrated Safety Management
KPI	Key Performance Indicator
NAS	National Airspace System
NATCA	National Air Traffic Controllers Association

Acronyms	
NextGen	Next Generation Air Transportation System
NTSB	National Transportation Safety Board
ODO	Opposite Direction Operations
OSA	Operational Skills Assessment
PASS	Professional Aviation Safety Specialists
PFS	Partnership for Safety
QA	Quality Assurance
QC	Quality Control
RAE	Risk Analysis Event
RAP	Risk Analysis Process
RCAT	Root Cause Analysis Team
RSC	Runway Safety Council
SMS	Safety Management System
SMTS	Safety Management Tracking System
SRER	System Risk Event Rate
SSR	System Service Review
T-SAP	Technical Operations Safety Action Program
UAS	Unmanned Aircraft Systems
VFR	Visual Flight Rules
VSRP	Voluntary Safety Reporting Program

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